United States
Department of
Agriculture

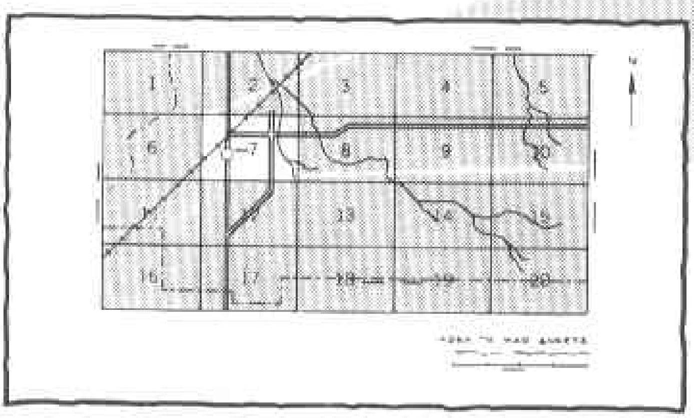
Soil
Conservation
Service

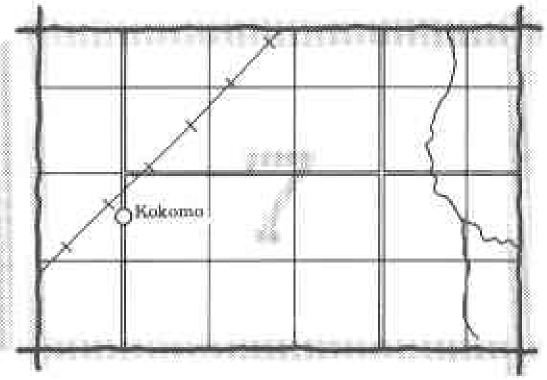
In cooperation with
Purdue University
Agricultural Experiment
Station and Indiana
Department of Natural
Resources, Soil and Water
Conservation Committee

# Soil Survey of Henry County, Indiana

# HOW TO USE

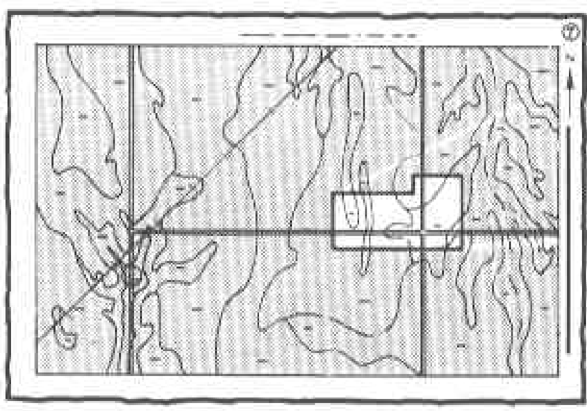
1. Locate your area of interest on the "Index to Map Sheets."

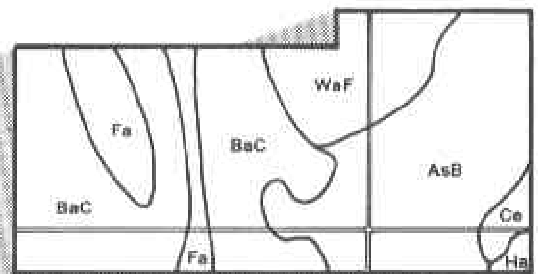


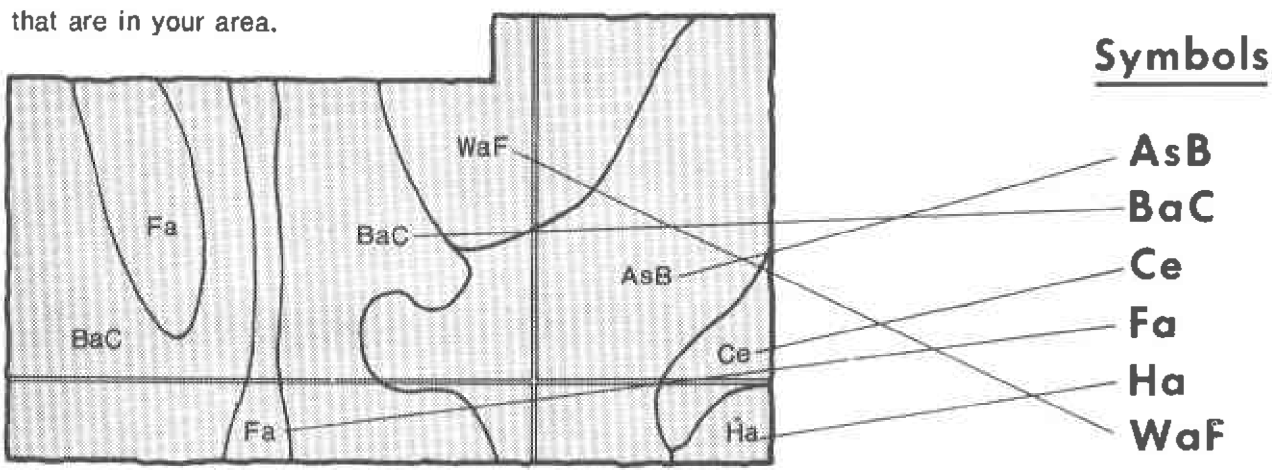

2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



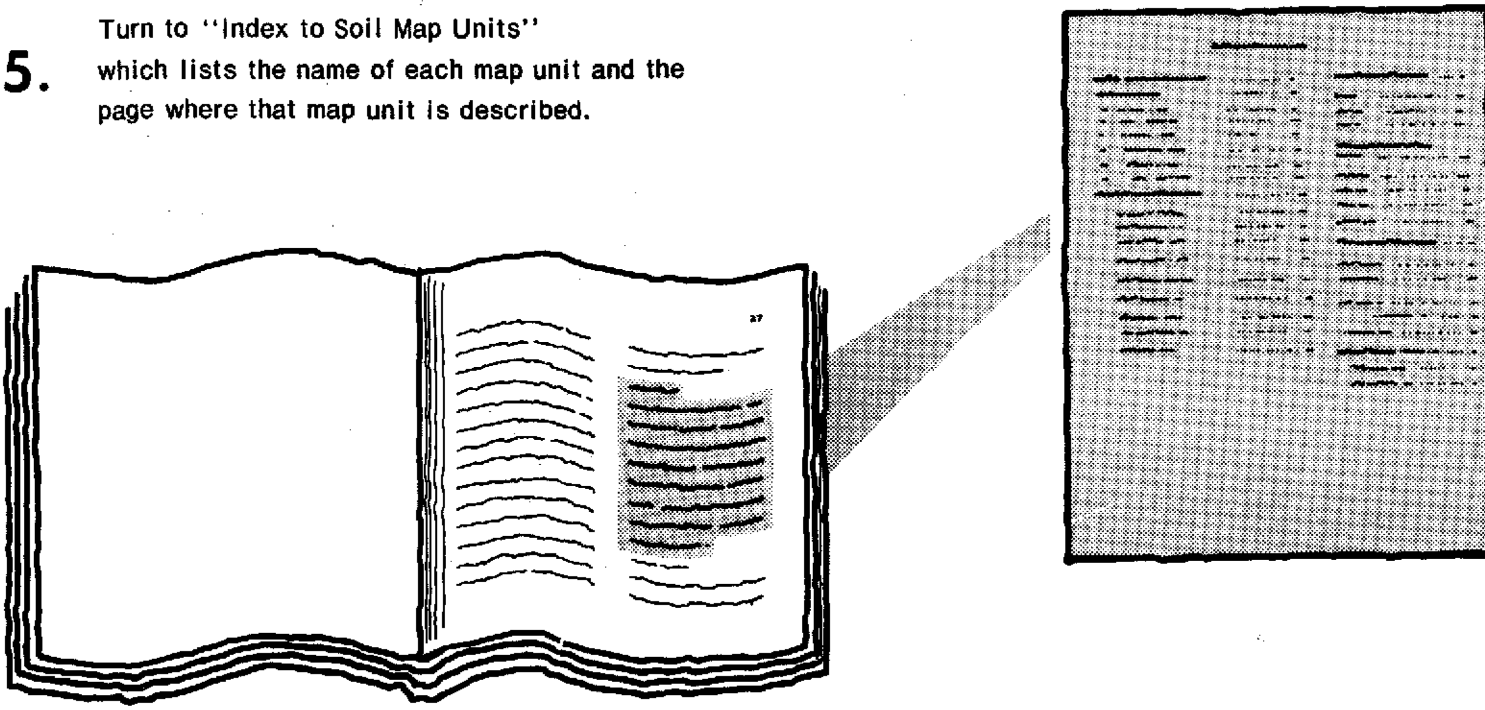



4. List the map unit symbols that are in your area.

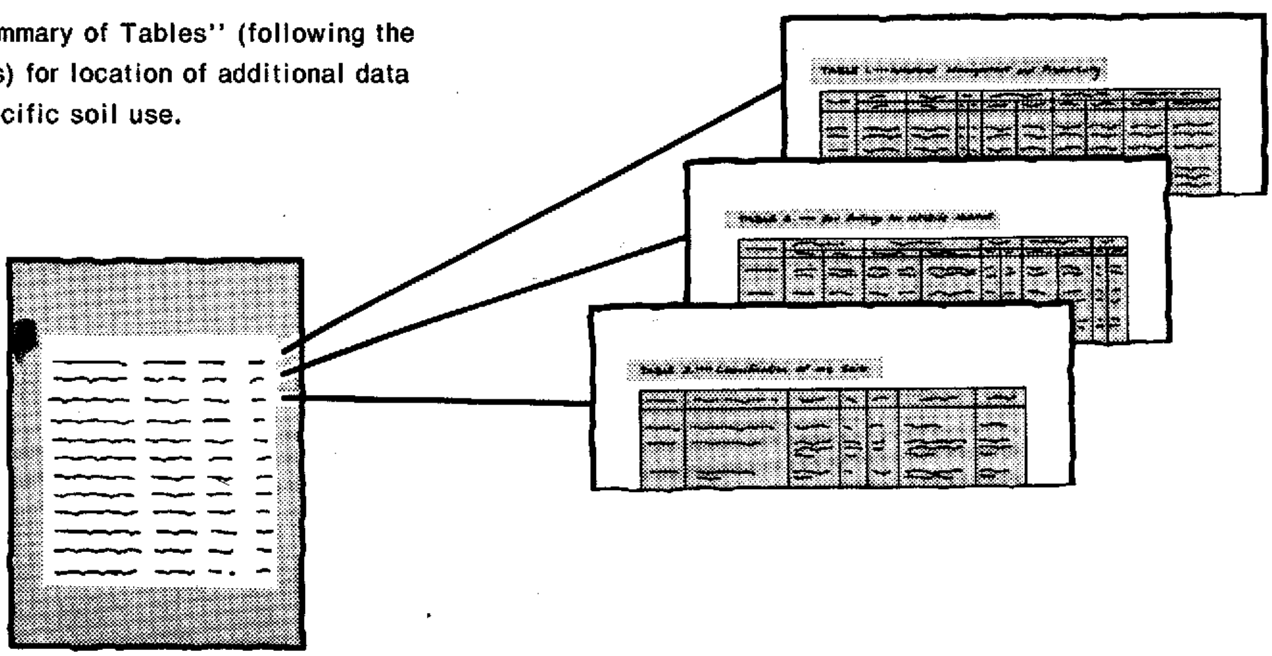


# THIS SOIL SURVEY

**5.** Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



**6.** See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



**7.** Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1981. Soil names and descriptions were approved in 1984. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1981. This survey was made cooperatively by the Soil Conservation Service, the Purdue University Agricultural Experiment Station, and the Indiana Department of Natural Resources, Soil and Water Conservation Committee. It is part of the technical assistance furnished to the Henry County Soil and Water Conservation District. Financial assistance was made available by the Board of County Commissioners of Henry County.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

**Cover: A small lake in an area of Losantville soils north of New Castle.**

# Contents

**Index to map units** .......... iv
**Summary of tables** .......... v
**Foreword** .......... vii
General nature of the county .......... 1
How this survey was made .......... 2
Map unit composition .......... 3
**General soil map units** .......... 5
Soil descriptions .......... 5
Broad land use considerations .......... 10
**Detailed soil map units** .......... 13
Soil descriptions .......... 13
Prime farmland .......... 41
**Use and management of the soils** .......... 43
Crops and pasture .......... 43
Woodland management and productivity .......... 46
Windbreaks and environmental plantings .......... 47
Recreation .......... 47
Wildlife habitat .......... 49
Engineering .......... 51
**Soil properties** .......... 57
Engineering index properties .......... 57
Physical and chemical properties .......... 58
Soil and water features .......... 59
**Classification of the soils** .......... 61
Soil series and their morphology .......... 61
**Formation of the soils** .......... 73
Factors of soil formation .......... 73
Processes of soil formation .......... 75
**References** .......... 77
**Glossary** .......... 79
**Tables** .......... 87

## Soil Series

Celina series .......... 61
Crosby series .......... 62
Cyclone series .......... 63
Eldean series .......... 63
Genesee series .......... 64
Landes series .......... 64
Losantville series .......... 65
Martisco series .......... 65
Miami series .......... 66
Miamian series .......... 66
Millgrove series .......... 67
Shoals series .......... 68
Sleeth series .......... 68
Sloan series .......... 69
Treaty series .......... 69
Washtenaw series .......... 70
Westland series .......... 71

Issued January 1987

# Index to Map Units


CeB2—Celina silt loam, 1 to 6 percent slopes, eroded .... 13
CfB2—Celina silt loam, stony subsoil, 1 to 6 percent slopes, eroded .... 14
CrA—Crosby silt loam, 0 to 3 percent slopes .... 15
CsA—Crosby silt loam, stony subsoil, 0 to 3 percent slopes .... 15
Cy—Cyclone silty clay loam .... 16
EdA—Eldean silt loam, 0 to 2 percent slopes .... 17
EdB2—Eldean silt loam, 2 to 6 percent slopes, eroded .... 17
EdC2—Eldean silt loam, 6 to 12 percent slopes, eroded .... 19
EdD2—Eldean silt loam, 12 to 18 percent slopes, eroded .... 19
EdE2—Eldean silt loam, 18 to 35 percent slopes, eroded .... 20
ExC3—Eldean clay loam, 6 to 12 percent slopes, severely eroded .... 21
ExD3—Eldean clay loam, 12 to 18 percent slopes, severely eroded .... 21
Ge—Genesee loam, occasionally flooded .... 22
La—Landes loam, rarely flooded .... 23
LeB2—Losantville silt loam, 2 to 6 percent slopes, eroded .... 23
LeC2—Losantville silt loam, 6 to 12 percent slopes, eroded .... 24
LeD2—Losantville silt loam, 12 to 18 percent slopes, eroded .... 24
LeE2—Losantville silt loam, 18 to 30 percent slopes, eroded .... 25
LhC3—Losantville clay loam, 6 to 12 percent slopes, severely eroded .... 26
LhD3—Losantville clay loam, 12 to 18 percent slopes, severely eroded .... 26
LsB2—Losantville silt loam, stony subsoil, 2 to 6 percent slopes, eroded .... 27
LsC2—Losantville silt loam, stony subsoil, 6 to 12 percent slopes, eroded .... 28
LsD2—Losantville silt loam, stony subsoil, 12 to 18 percent slopes, eroded .... 28
LsE2—Losantville silt loam, stony subsoil, 18 to 30 percent slopes, eroded .... 29
LxC3—Losantville clay loam, stony subsoil, 6 to 12 percent slopes, severely eroded .... 30
LxD3—Losantville clay loam, stony subsoil, 12 to 18 percent slopes, severely eroded .... 30
Ma—Martisco muck, drained .... 31
MlA—Miami silt loam, gravelly substratum, 0 to 2 percent slopes .... 32
MlB2—Miami silt loam, gravelly substratum, 2 to 6 percent slopes, eroded .... 32
MmB2—Miamian silt loam, 2 to 6 percent slopes, eroded .... 33
MoB2—Miamian silt loam, stony subsoil, 2 to 6 percent slopes, eroded .... 34
Mx—Millgrove loam .... 34
Ot—Orthents and Aquents, loamy .... 35
Pt—Pits, gravel .... 35
Sg—Shoals loam, occasionally flooded .... 36
Sk—Sleeth silt loam .... 36
Sn—Sloan silty clay loam, occasionally flooded .... 37
Ts—Treaty silt loam, stony subsoil .... 37
Wb—Washtenaw silt loam .... 39
We—Westland silt loam .... 39

# Summary of Tables

Temperature and precipitation (table 1) .......... 88
Freeze dates in spring and fall (table 2) .......... 89
*Probability. Temperature.*
Growing season (table 3) .......... 89
Acreage and proportionate extent of the soils (table 4) .......... 90
*Acres. Percent.*
Prime farmland (table 5) .......... 91
Land capability classes and yields per acre of crops and pasture (table 6) .......... 92
*Land capability. Corn. Soybeans. Winter wheat. Bromegrass-alfalfa hay. Tall fescue.*
Capability classes and subclasses (table 7) .......... 94
*Total acreage. Major management concerns.*
Woodland management and productivity (table 8) .......... 95
*Ordination symbol. Management concerns. Potential productivity. Trees to plant.*
Windbreaks and environmental plantings (table 9) .......... 98
Recreational development (table 10) .......... 101
*Camp areas. Picnic areas. Playgrounds. Paths and trails. Golf fairways.*
Wildlife habitat (table 11) .......... 103
*Potential for habitat elements. Potential as habitat for—Openland wildlife, Woodland wildlife, Wetland wildlife.*
Building site development (table 12) .......... 105
*Shallow excavations. Dwellings without basements. Dwellings with basements. Small commercial buildings. Local roads and streets. Lawns and landscaping.*
Sanitary facilities (table 13) .......... 108
*Septic tank absorption fields. Sewage lagoon areas. Trench sanitary landfill. Area sanitary landfill. Daily cover for landfill.*
Construction materials (table 14) .......... 111
*Roadfill. Sand. Gravel. Topsoil.*
Water management (table 15) .......... 113
*Limitations for—Pond reservoir areas; Aquifer-fed excavated ponds. Features affecting—Drainage, Irrigation, Terraces and diversions, Grassed waterways.*

Engineering index properties (table 16) .......................................................... 115
*Depth. USDA texture. Classification—Unified, AASHTO. Fragments greater than 3 inches. Percentage passing sieve number—4, 10, 40, 200. Liquid limit. Plasticity index.*
Physical and chemical properties of the soils (table 17) .............................. 118
*Depth. Clay. Moist bulk density. Permeability. Available water capacity. Soil reaction. Shrink-swell potential. Erosion factors. Wind erodibility group. Organic matter.*
Soil and water features (table 18)..................................................................... 120
*Hydrologic group. Flooding. High water table. Bedrock. Potential frost action. Risk of corrosion.*
Classification of the soils (table 19)................................................................. 122
*Family or higher taxonomic class.*

# Foreword

This soil survey contains information that can be used in land-planning programs in Henry County, Indiana. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

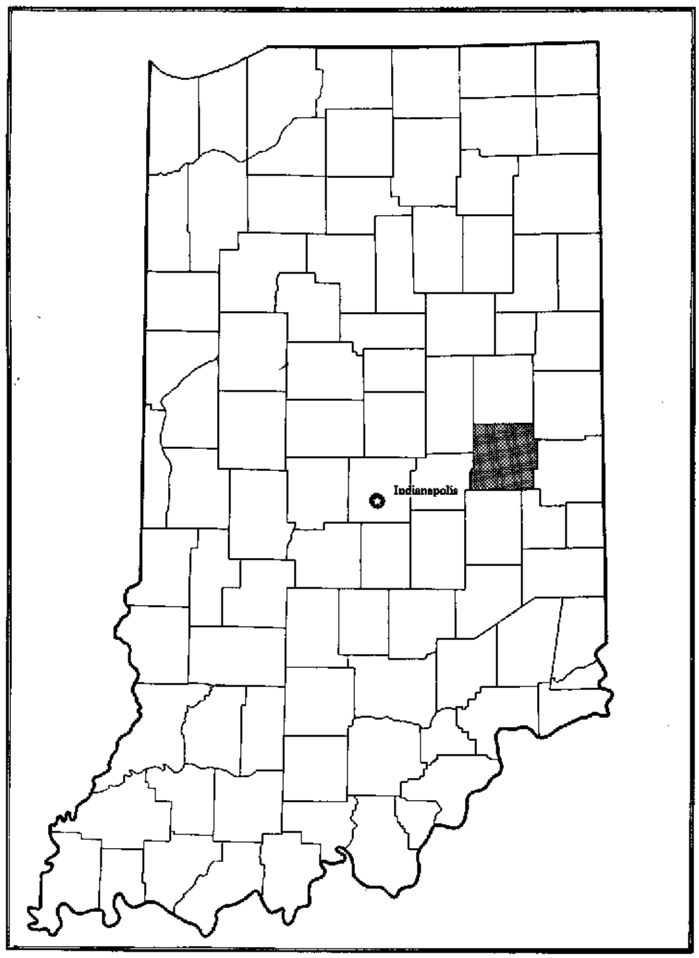
This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Robert L Eddleman

Robert L. Eddleman
State Conservationist
Soil Conservation Service




**Location of Henry County in Indiana.**

# Soil Survey of Henry County, Indiana

By John H. Hillis and Travis Neely, Soil Conservation Service

Fieldwork by John H. Hillis and Bobby L. Pirtle, Soil Conservation Service, and Roxann C. Klika, Robert C. Jones, and Gary S. LeMasters, Indiana Department of Natural Resources, Soil and Water Conservation Committee

United States Department of Agriculture, Soil Conservation Service, in cooperation with
Purdue University Agricultural Experiment Station
and Indiana Department of Natural Resources,
Soil and Water Conservation Committee

HENRY COUNTY is in east-central Indiana (see facing page). It has an area of 252,499 acres, or about 395 square miles. It extends about 20 miles from north to south and 20 miles from east to west. New Castle, which is in the center of the county, is the county seat. Most of the county residents make their living from farming or work at factories in New Castle and in adjacent counties.

About 70 percent of the acreage in the county is used for cultivated crops. Corn, soybeans, and wheat are the principal crops. A tomato-processing plant is located at Mount Summit. The county has several orchards.

## General Nature of the County

The paragraphs that follow give general information about Henry County. They describe relief, water supply, climate, transportation facilities, and trends in population.

### Relief

Elevation ranges from about 880 to 1,190 feet above sea level in Henry County. The highest elevations are in Stony Creek and Blue River Townships, which border Randolph and Wayne Counties. The lowest elevation is in an area where the Big Blue River flows south out of the county. This area is near Knightstown, in Wayne Township.

The county is on a flat to gently rolling glacial till plain dissected by the Big Blue River, the Flatrock River, Fall Creek, and numerous other creeks, streams, and drainageways. Low relief and few abrupt changes characterize the physiography. The greatest local relief, in places more than 100 feet, is along the sluiceway of Big Blue River. Some moderately sloping to steep areas are in Stony Creek and Blue River Townships, in the northeastern part of the county.

### Water Supply

Ground water is the main source of water in Henry County. It is readily available. More than 40 wells in the county pump ground water for public and industrial uses. They supply water to more than 90 percent of the residents in the county. The average depth of these wells is 150 feet.

Surface water resources are rather limited. The county has a number of small farm ponds, private lakes, and abandoned gravel pits. It has no natural lakes of significant size. In the future, water areas will be developed west of New Castle and northeast of Mount Summit. The area near New Castle will be approximately 560 acres in size, and the one near Mount Summit will be 835 acres in size. Both areas will provide opportunities for camping, boating, picnicking, and other recreational activities.

## Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Henry County is cold in winter but quite hot in summer. Winter precipitation, frequently snow, results in a good accumulation of soil moisture by spring and minimizes drought during summer on most soils. The normal annual precipitation is adequate for all crops that are adapted to the temperature and the length of the growing season in the county.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Cambridge City, Indiana, in the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 28 degrees F, and the average daily minimum temperature is 19 degrees. The lowest temperature on record, which occurred at Cambridge City, on January 29, 1963, is -28 degrees. In summer the average temperature is 71 degrees, and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred on July 29, 1952, is 102 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 40 inches. Of this, about 23 inches, or 58 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 4.19 inches at Cambridge City, on July 20, 1969. Thunderstorms occur on about 45 days each year, and most occur in spring. Tornadoes and severe thunderstorms occur occasionally. These storms are usually local in extent and of short duration and cause damage in scattered areas.

The average seasonal snowfall is about 22 inches. The greatest snow depth at any one time during the period of record was 11 inches. On the average, 14 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in spring.

## Transportation Facilities

The major transportation corridors in the county are Interstate 69, U.S. Highway 35, Interstate 70, and State Road 3. Additional routes are U.S. Highways 36 and 40; State Roads 236, 103, 234, 109, and 38; and county roads. A large percentage of the county roads are surfaced with gravel.

Three main railroads cross the county. No rail passenger service is available in the county. A bus line provides connector service to most major cities. Most freight service is provided by intrastate and interstate truck lines. One airport provides general utility service.

## Trends in Population

Henry County had a population of 53,421 in 1980 (*7*). During the first 100 years of the county's history, the farm population greatly outnumbered that of the towns. Because of the growth of industrial, commercial, and service enterprises and the consolidation of farms, the city-suburban population is now higher than the farm population. The growth of urban areas is expected to level off in the future.

# How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil

scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

## Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

# General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one map unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The names, descriptions, and delineations of the soils identified on the general soil map of this county do not always agree or join fully with those of the soils identified on the maps of adjoining counties published at an earlier date. Some differences are the result of changes in concepts of soil series. Other differences result from variations in the extent of the soils. Others are the result of variations in the slope range allowed in the map units.

## Soil Descriptions

### 1. Crosby-Cyclone-Miamian

*Deep, nearly level and gently sloping, somewhat poorly drained, poorly drained, and well drained, medium textured and moderately fine textured soils formed in loess or silty material and in the underlying loamy glacial till; on till plains and moraines*

This map unit is in nearly level and gently sloping areas characterized by swells and swales. It is throughout the county. Most areas are drained by small natural drainageways, which lead into open ditches, or by small streams, which flow into the larger streams. Slopes range from 0 to 6 percent.

This map unit makes up about 46 percent of the county. It is about 40 percent Crosby soils, 39 percent Cyclone soils, 6 percent Miamian soils, and 15 percent minor soils (fig. 1).

Crosby soils are on the higher, broad flats and slight swells and are somewhat poorly drained. They are nearly level and gently sloping. Typically, the surface layer is dark grayish brown silt loam. The subsoil is brown, mottled, firm silt loam and silty clay loam in the upper part and yellowish brown clay loam in the lower part.

Cyclone soils are in the more depressional areas, in swales, and along poorly defined drainageways and are poorly drained. They are nearly level. Typically, the surface layer is very dark grayish brown silty clay loam. The subsoil is dark gray, gray, and yellowish brown, mottled, firm silty clay loam and clay loam.

Miamian soils are in the slightly higher, gently sloping areas and are well drained. Typically, the surface soil is dark brown silt loam. The subsoil is dark yellowish brown and yellowish brown, firm clay loam and clay.

The minor soils in this map unit are the Losantville, Miami, Celina, and Millgrove soils. Orthents and Aquents also are of minor extent. The well drained Losantville soils are on knobs and breaks along drainageways. The depth to their substratum is less than 20 inches. The well drained Miami and moderately well drained Celina soils are on rises and broad flats. The very poorly drained Millgrove soils are in narrow to broad areas along drainageways.

This map unit is used mainly for cultivated crops. Most of the acreage has been drained and is well suited to corn, soybeans, and small grain. Some areas are used as pasture. Overgrazing and grazing when the soils are too wet are the major concerns in managing pasture. The wetness is the main limitation affecting farming and most other uses.

A very small acreage of this map unit is woodland. The soils are well suited to trees. The common tree species are white oak, white ash, sugar maple, and northern red oak. Water-tolerant species are favored in timber stands.

This map unit is poorly suited to sanitary facilities and dwellings. Wetness and ponding are the main limitations. Installing an adequate drainage system is the first management consideration if the soils are used for urban development.

### 2. Miamian-Losantville

*Deep, gently sloping to steep, well drained, medium textured and moderately fine textured soils formed in glacial till or in a thin mantle of loess and the underlying loamy glacial till; on till plains and moraines*

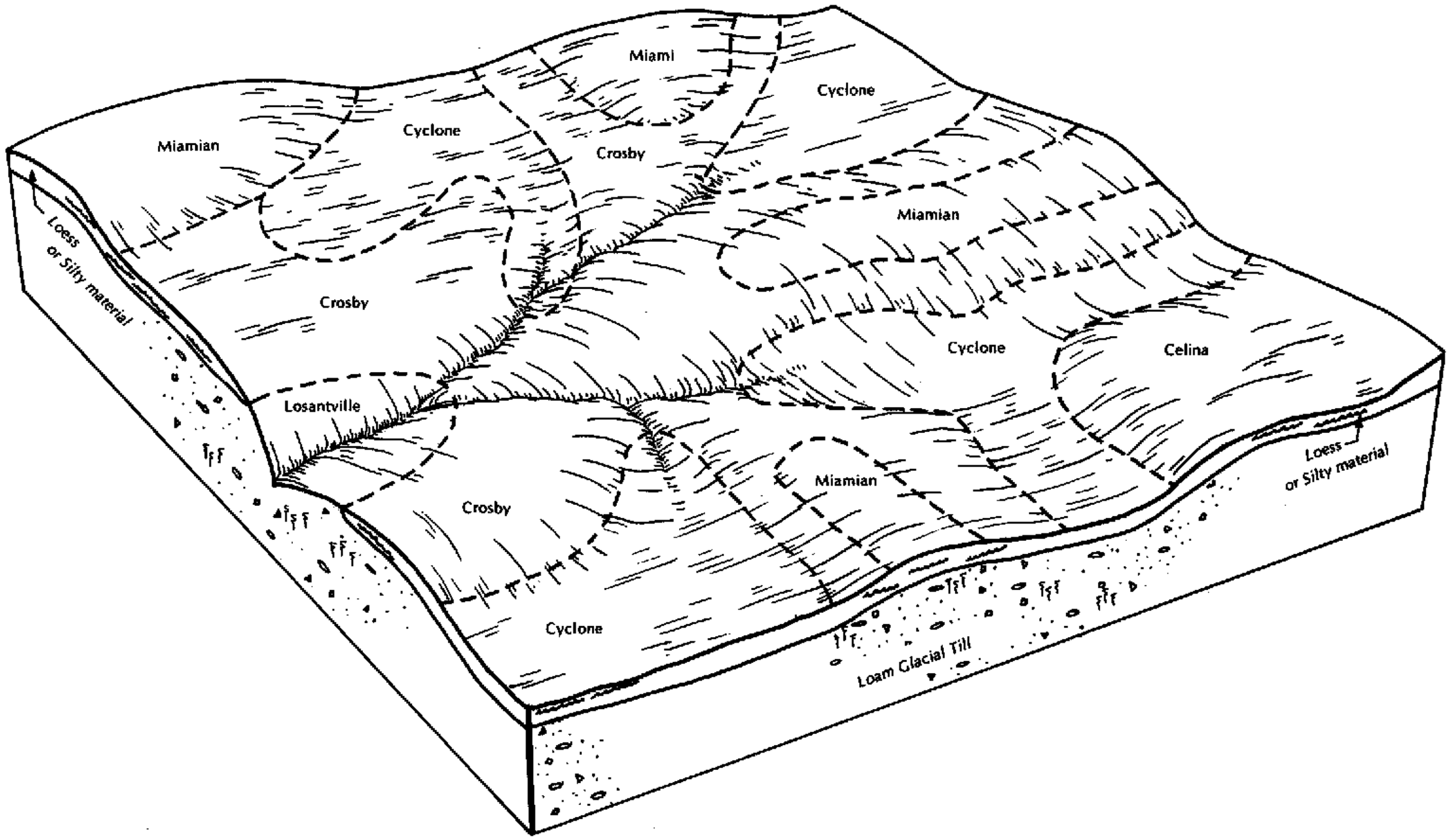



**Figure 1.—Pattern of soils and parent material in the Crosby-Cyclone—Miamian map unit.**

This map unit is on knobs and breaks along the major streams and many of the minor ones. The terrain generally is very hilly and rolling but is nearly level near some of the edges of the mapped areas. Most areas are drained by small natural drainageways, which flow into the major streams. Slopes range from 0 to 30 percent.

This map unit makes up about 29 percent of the county. It is about 29 percent Miamian soils, 28 percent Losantville soils, and 43 percent minor soils (fig. 2).

Miamian soils are on ridges between drainageways and on till plains. They are gently sloping. Typically, the surface layer is dark brown silt loam. The subsoil is dark yellowish brown and yellowish brown, firm clay loam and clay. The substratum is loam glacial till. Sand and gravel are at a depth of 5 to 12 feet in some of the more nearly level areas.

Losantville soils are on knobs and breaks between drainageways. They are gently sloping to steep. Typically, the surface layer is brown silt loam. The subsoil is dark yellowish brown, firm clay loam.

The minor soils in this map unit are the Eldean, Miami, Celina, Cyclone, Washtenaw, and Crosby soils and some alluvial soils. Gravel pits and areas of water also are of minor extent. The well drained Eldean soils are in pockets of outwash and are underlain by deep deposits of sand and gravel. The well drained Miami and moderately well drained Celina soils are on rises and side slopes. The poorly drained Cyclone and Washtenaw soils are in depressions and small drainageways. The somewhat poorly drained Crosby soils are in the slightly lower landscape positions.

This map unit is fairly well suited to cultivated crops. The slope and the hazard of erosion are the main management concerns. The hilly soils, most of which are cleared, are well suited to hay. Many areas are used as pasture. Overgrazing and grazing when the soils are wet are the major concerns in managing pasture. They increase the susceptibility to erosion and gullying.

A large acreage of this map unit is woodland. The soils are well suited to trees. The common tree species are white oak, northern red oak, yellow-poplar, black walnut, white ash, sugar maple, and black cherry.

In most areas this map unit is only fairly well suited to sanitary facilities and dwellings because of the slope and slow permeability. The more nearly level Miamian soils, however, are well suited to dwellings.

### 3. Eldean

*Nearly level to strongly sloping, well drained, medium textured and moderately fine textured soils that are moderately deep over sand and gravel; formed in outwash material on outwash plains, moraines, and terraces*

This map unit is on nearly level outwash plains and gently sloping to strongly sloping terraces and moraines bordering the major streams. Most areas are drained by small natural drainageways, which lead into the major streams. Slopes range from 0 to 18 percent.

This map unit makes up about 9 percent of the county. It is about 81 percent Eldean soils and 19 percent minor soils (fig. 3).

Typically, the Eldean soils have a surface layer of dark grayish brown silt loam and a subsurface layer of grayish brown loam. The subsoil is dark brown and dark reddish brown, firm clay loam, clay, and sandy clay in the upper part and dark reddish brown, friable gravelly sandy clay loam in the lower part. These soils are underlain by sand and gravel at a depth of 20 to 40 inches.

The minor soils in this map unit are the Losantville, Millgrove, Westland, and Sleeth soils and some alluvial soils. The well drained Losantville soils are on the steeper slopes. They are underlain by loamy till. The very poorly drained Millgrove and Westland soils are in depressions and along small drainageways. The somewhat poorly drained Sleeth soils are in the slightly lower positions on the landscape.

This map unit is well suited to cultivated crops. Droughtiness is a slight limitation. Erosion is a hazard in the more sloping areas. Some areas are used as pasture. Overgrazing and grazing when the soils are too wet are the major concerns in managing pasture.

A small acreage of this map unit is woodland. The soils are well suited to trees. The common tree species are white oak, northern red oak, yellow-poplar, sugar maple, and white ash.

This map unit is fairly well suited to sanitary facilities and dwellings. If the Eldean soils are used as sites for sanitary facilities, the ground water can be contaminated because of rapid permeability in the substratum.

### 4. Westland-Millgrove-Martisco

*Deep, nearly level, very poorly drained, medium textured*

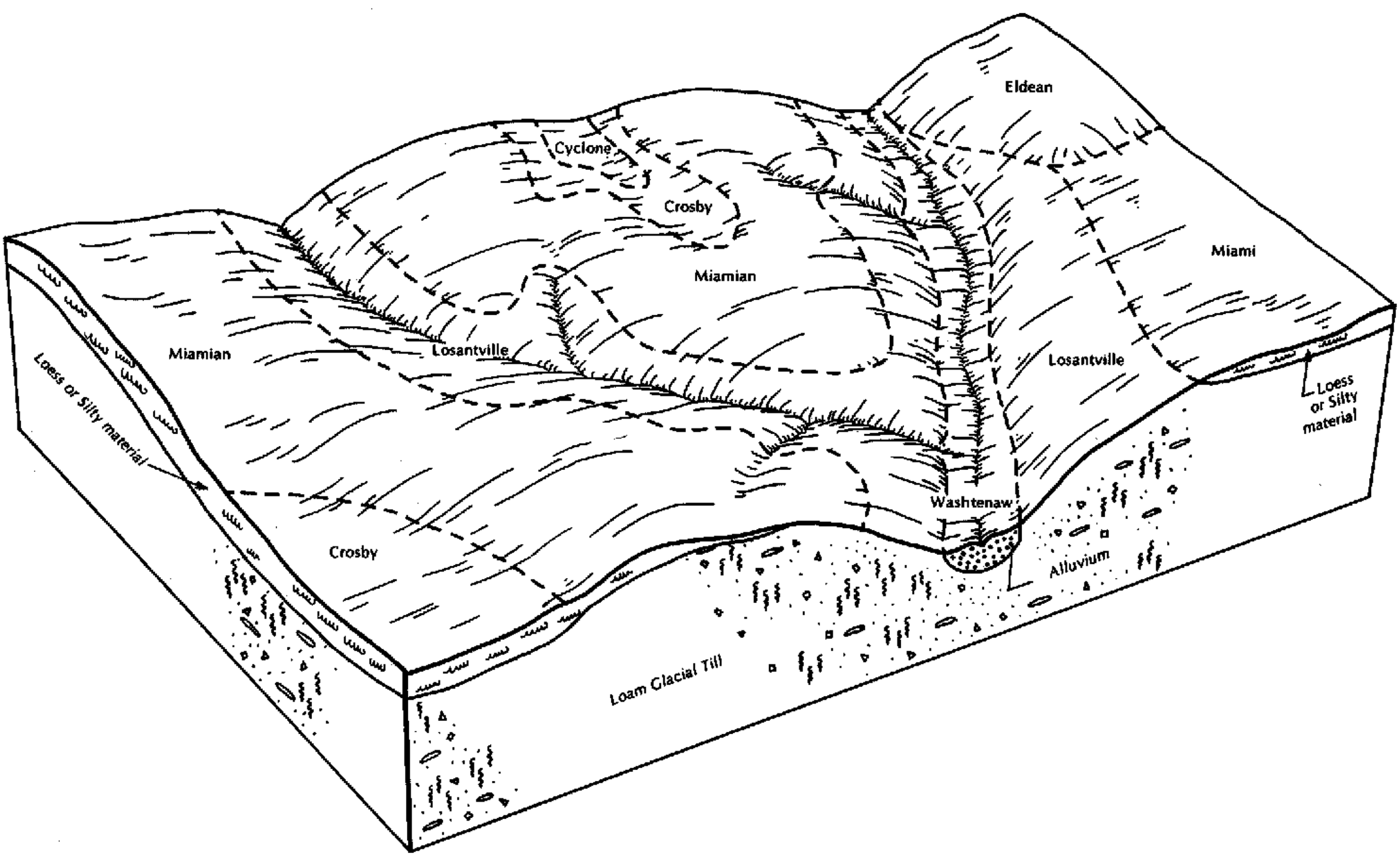



**Figure 2.—Pattern of soils and parent material in the Miamian-Losantville map unit.**

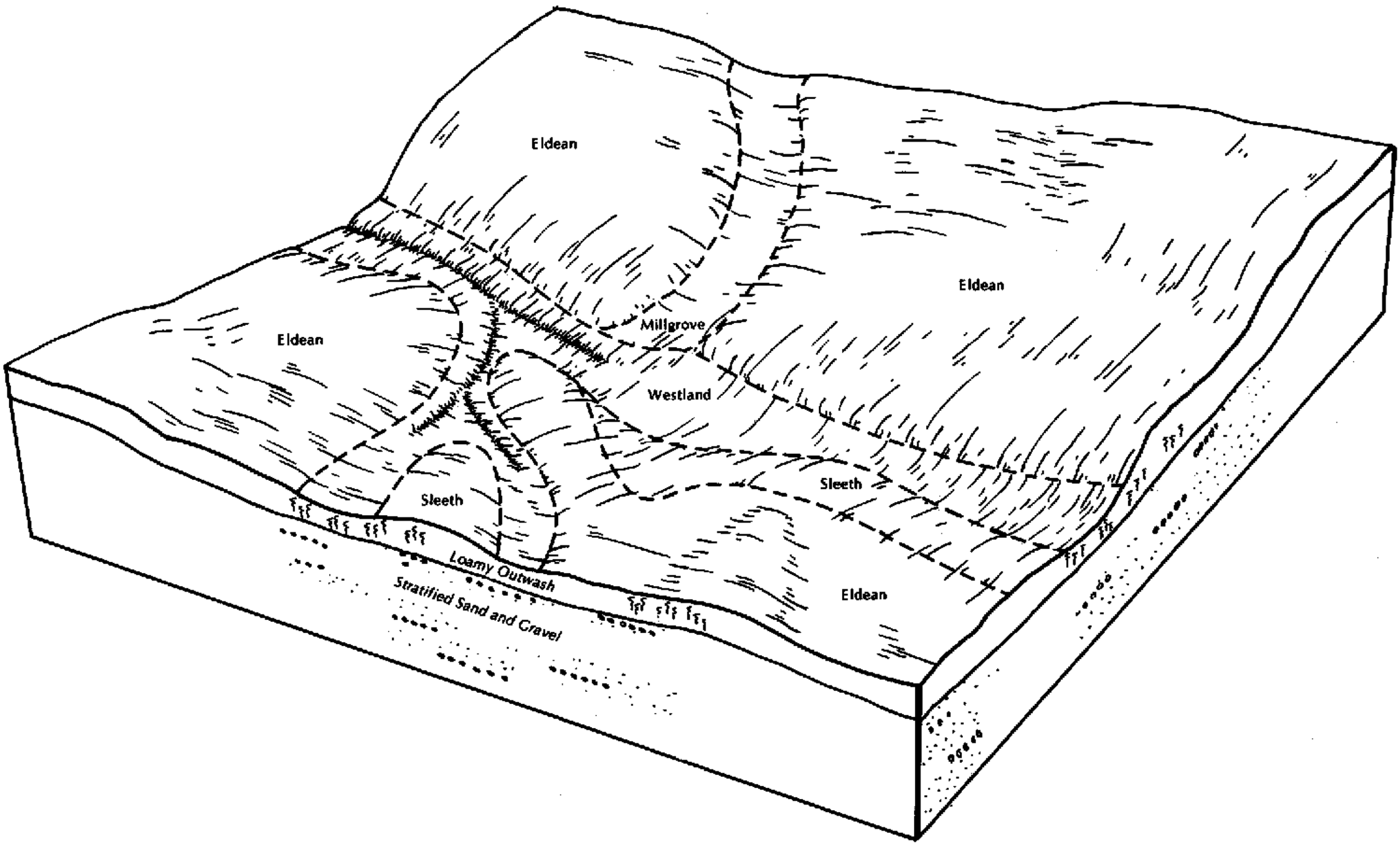



**Figure 3.—Pattern of soils and parent material in the Eldean map unit.**

*or mucky soils formed in glacial outwash sediments and organic deposits; on outwash plains, terraces, and valley trains*

This map unit is in broad, nearly level areas bordering the major stream channels. It is mainly along the Big Blue River and Buck Creek. Most areas are drained by ditches leading into the major streams. Slopes range from 0 to 2 percent.

This map unit makes up about 6 percent of the county. It is about 51 percent Westland soils, 21 percent Millgrove soils, 8 percent Martisco soils, and 20 percent minor soils (fig. 4).

Westland soils are in broad, nearly level and depressional areas along the stream channels. Typically, the surface layer is very dark grayish brown silt loam. The subsoil is dark grayish brown and grayish brown, mottled, firm clay loam and gravelly sandy clay loam. The substratum is grayish brown gravelly coarse sand.

Millgrove soils are in broad, nearly level and depressional areas along the stream channels. Typically, they have a surface layer of very dark gray loam and a subsurface layer of very dark gray clay loam. The subsoil is grayish brown and dark gray, mottled, firm clay loam and dark gray, mottled, friable and firm loam. The substratum is grayish brown gravelly loam.

Martisco soils are in the deeper depressions and low pockets. Areas of these soils are intermingled with areas of the Westland and Millgrove soils. Typically, the surface layer is black muck. The substratum is light brownish gray marl, gray, massive gravelly loam, and gray very gravelly sandy loam.

The minor soils in this map unit are the Sleeth, Eldean, Genesee, Landes, Shoals, and Losantville soils. The somewhat poorly drained Sleeth and well drained Eldean soils are in the slightly higher landscape positions. The well drained Genesee, Landes, and Losantville soils and the somewhat poorly drained Shoals soils are in the higher landscape positions bordering areas of more poorly drained soils.

This map unit is used mainly for cultivated crops. Most of the acreage has been drained and is well suited to corn and soybeans. Very few areas are used as pasture. Overgrazing and grazing when the soils are too wet are

the major concerns in managing pasture. Wetness is the main limitation affecting farming and most other uses.

A very small acreage of this map unit is woodland. The soils are well suited to trees. The common tree species are pin oak, eastern cottonwood, silver maple, red maple, and northern red oak. Water-tolerant species are favored in timber stands.

This map unit is poorly suited to sanitary facilities and dwellings. Wetness and ponding are the main limitations. Installing an adequate drainage system is the first management consideration if the soils are used for urban development.

### 5. Genesee-Shoals-Landes

*Deep, nearly level, well drained and somewhat poorly drained, medium textured soils formed in loamy alluvial deposits; on bottom land*

This map unit is on bottom land in areas bordering the major stream channels and some of the minor ones. It is mainly along the Big Blue River. Most areas are drained by ditches and natural drainageways leading into the major streams. Slopes range from 0 to 2 percent.

This map unit makes up about 3 percent of the county. It is about 25 percent Genesee soils, 20 percent Shoals soils, 10 percent Landes soils, and 45 percent minor soils.

Genesee soils are on the bottom land along the major streams and some of the minor ones. They are well drained. Typically, the surface layer is very dark grayish brown loam. The subsoil is dark brown and dark grayish brown, friable loam. The substratum is dark yellowish brown, friable, stratified loam and sandy loam.

Shoals soils are on bottom land along the major stream channels and some of the minor ones. They are somewhat poorly drained. Typically, the surface layer is dark grayish brown loam. The substratum is dark grayish brown, dark brown, and grayish brown, mottled, friable loam and gray, mottled, massive, stratified loam, silt loam, loamy sand, and sandy loam.

Landes soils are mainly along the minor stream channels. They are well drained. Typically, the surface layer is very dark grayish brown loam. The subsoil is yellowish brown, friable loam. The substratum is yellowish brown, mottled fine sandy loam and brown gravelly loamy coarse sand.

The minor soils in this map unit are the Sloan, Martisco, Millgrove, Westland, Sleeth, Eldean, and Losantville soils. The very poorly drained Sloan soils are in the same positions on bottom land as the major soils. The very poorly drained Martisco, Millgrove, and Westland soils are in low depressions. The somewhat poorly drained Sleeth soils are on the slightly higher

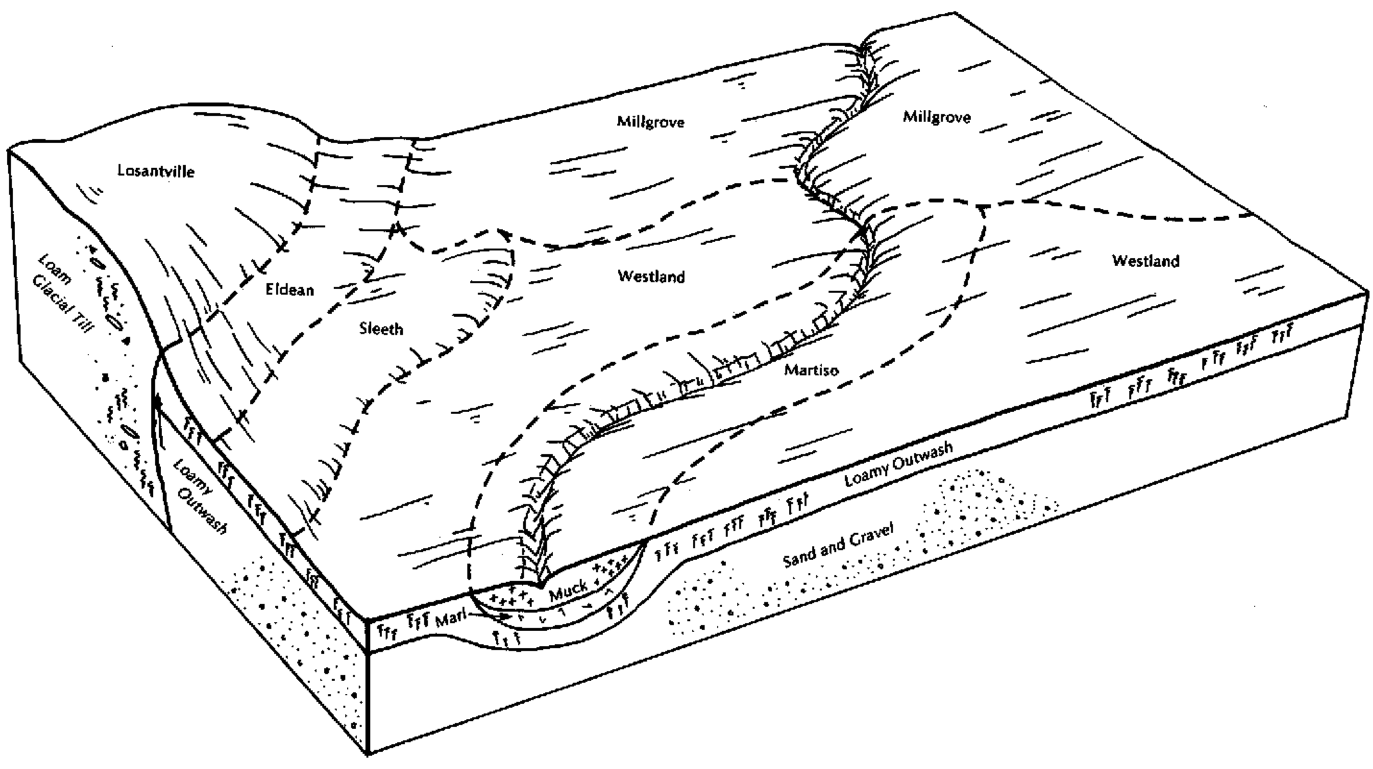



**Figure 4.—Pattern of soils and parent material in the Westland-Millgrove-Martisco map unit.**

terraces bordering the bottom land. They contain more gravel than the major soils. The well drained Eldean and Losantville soils are in the higher areas bordering the bottom land.

This map unit is used mainly for cultivated crops. Most of the acreage has been drained and is well suited to corn and soybeans. Very few areas are used as pasture. Overgrazing and grazing when the soils are too wet are the major concerns in managing pasture. Wetness is the main limitation affecting farming and most other uses.

A small acreage of this map unit is woodland. The soils are well suited to trees. The common tree species are yellow-poplar, white ash, eastern cottonwood, pin oak, and American sycamore. Water-tolerant species are favored in timber stands.

This map unit is poorly suited to sanitary facilities and dwellings. The hazard of flooding and the wetness are the main management concerns. An alternative site should be chosen for urban development.

#### 6. Losantville-Crosby-Miamian

*Deep, nearly level to steep, well drained and somewhat poorly drained, medium textured and moderately fine textured soils formed in glacial till or in a thin mantle of loess and the underlying loamy glacial till; on till plains and moraines*

This map unit is on knobs and breaks along the upper reaches of the Big Blue River and Buck Creek and along some minor streams. It also is in some nearly level areas characterized by swells and swales. The nearly level areas are throughout Stony Creek Township and in parts of Prairie and Blue River Townships. The terrain generally is very hilly to rolling but is nearly level near many of the edges of the mapped areas. The unit has an abundance of stones. Slopes range from 0 to 30 percent.

This map unit makes up about 7 percent of the county. It is about 24 percent Losantville soils, 21 percent Crosby soils, 17 percent Miamian soils, and 38 percent minor soils.

Losantville soils are in gently sloping to steep areas on breaks between drainageways. They are well drained. Typically, the surface layer is dark grayish brown silt loam. The subsoil is dark yellowish brown, firm clay loam.

Crosby soils are in nearly level areas characterized by swells and swales. They are somewhat poorly drained. Typically, the surface layer is dark grayish brown silt loam. The subsoil is brown, mottled, firm clay loam and loam.

Miamian soils are well drained and are on ridges between drainageways and on till plains. They are well drained and are gently sloping. Typically, the surface layer is brown silt loam. The subsoil is yellowish brown, firm silty clay loam and clay loam.

The minor soils in this map unit are the Eldean, Miami, Celina, Treaty, and Washtenaw soils. Areas of water on broad flats or undulating plains also are of minor extent. The well drained Eldean soils are in pockets of outwash. The well drained Miami soils are on till plains. Eldean and Miami soils are underlain by deep deposits of sand and gravel. The moderately well drained Celina soils are on undulating till plains. The poorly drained Treaty and Washtenaw soils are in depressions and small drainageways.

The Crosby and Miamian soils generally are cultivated. Most of the soils in this map unit are fairly well suited to cultivated crops, but the strongly sloping or steeper Losantville soils are poorly suited. Most areas have been drained. The slope and the hazard of erosion are the main management concerns. The hilly soils, most of which are cleared, are fairly well suited to pasture. Most areas of the steeper Losantville soils are pastured. Large stones can hinder tilling and haying. They also can hinder the installation of subsurface drains in the Crosby soils. Overgrazing and grazing when the soils are wet are the major concerns in managing pasture. They can damage the vegetation and increase the susceptibility to erosion.

A large acreage of this map unit is woodland. The soils are well suited to trees. The common tree species on the Crosby soils are white oak, pin oak, white ash, American beech, sugar maple, and northern red oak. Yellow-poplar, black walnut, northern red oak, and black cherry are common on the Losantville and Miamian soils.

Most of the soils in this map unit are poorly suited to sanitary facilities and dwellings. The Miamian soils, however, are well suited to dwellings. Installing an adequate drainage system is the first management consideration if the Crosby soils are used for urban development. Slope and restricted permeability are limitations if the Losantville soils are used as sites for dwellings and sanitary facilities. Restricted permeability is a limitation if the Miamian soils are used as sites for sanitary facilities.

## Broad Land Use Considerations

The soils in Henry County vary widely in their suitability for major land uses. Approximately 55 percent of the county is used for cultivated crops, mainly corn and soybeans. The cropland is in scattered areas throughout the county but is mainly in map units 1 and 3, which are well suited or fairly well suited to cultivated crops. The major soils in map units 4 and 5 are occasionally ponded or flooded, principally in winter and early in spring. The ponding or flooding causes slight or moderate crop damage. Map units 2 and 6 are in the steeper areas on uplands where erosion is the main hazard affecting crops.

Approximately 8 percent of the county is pastured. Map units 2, 3, and 6 are well suited to grasses and legumes.

About 7 percent of the county is woodland. The productivity of the soils for hardwoods is high in map units 2, 3, and 6. The use of equipment is restricted by wetness on some soils.

About 29,800 acres in the county is urban or built-up land. In general, the gently sloping and moderately sloping Eldean and Miamian soils are fairly well suited to urban uses. These soils are mainly in map units 2 and 3. In the other map units, slow permeability, low strength, wetness, flooding, and slope are the principal limitations. The soils in map units 4 and 5 are poorly suited to urban development because of ponding and flooding. The steeper soils in map units 2 and 6 generally are poorly suited because of slope and slow permeability. Sites that are suitable for houses or small commercial buildings, however, are available in some areas of these units.

The suitability for recreation uses ranges from poor to good, depending on the intensity of the expected use and the properties of the soils. Most of the soils in map units 2 and 3 are fairly well suited to intensive recreational uses, such as playgrounds and camping areas. Map units 1, 4, and 5 are poorly suited because of wetness, ponding, and flooding. The slope limits intensive recreational development in map units 2 and 6. Map units 2, 3, and 6 are suitable for extensive recreational uses, such as trails for hiking or horseback riding. Some small areas in map units 1, 4, and 5 are suitable for these uses.

The suitability for wildlife habitat is generally good throughout the county. Map units 2, 3, and 6 are well suited to openland and woodland wildlife habitat. Map units 1 and 4 are well suited to wetland wildlife habitat.

# Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Losantville silt loam, 6 to 12 percent slopes, eroded, is one of several phases in the Losantville series.

Some map units are made up of two or more major soils. These map units are called undifferentiated groups. An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in the mapped areas are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Orthents and Aquents, loamy, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, gravel, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

The names, descriptions, and delineations of the soils identified on the detailed soil maps of this county do not always agree or join fully with those of the soils identified on the maps of adjoining counties published at an earlier date. Some differences are the result of changes in concepts of soil series. Other differences result from variations in the extent of the soils. Others are the result of variations in the slope range allowed in the map units.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

## Soil Descriptions

**CeB2—Celina silt loam, 1 to 6 percent slopes, eroded.** This gently sloping, moderately well drained soil is on slight rises on broad till plains. Individual areas are irregular in shape and range from 3 to 20 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 9 inches thick. The subsoil is mottled, firm clay loam about 23 inches thick. The upper part is dark yellowish brown, and the lower part is yellowish brown. The substratum to a depth of about 60 inches is yellowish brown loam. In some areas the subsoil has less clay. In other areas the depth to firm glacial till is more than 40 or less than 20 inches. In places the lower part of the subsoil is stratified with silt loam, sandy loam, silty clay loam, or sand.

Included with this soil in mapping are the somewhat poorly drained Crosby soils in the lower landscape positions and the dark, poorly drained Cyclone soils in depressions. Also included are the well drained Miamian soils on slightly high rises and many very small areas on severely eroded knobs where the calcareous till is at or

near the surface. Included soils make up 3 to 5 percent of the map unit.

Available water capacity is moderate in the Celina soil. Permeability is moderate or moderately slow. Surface runoff is medium. The seasonal high water table is at a depth of 2.0 to 3.5 feet in winter and early in spring. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are farmed. Many are used for corn, soybeans, or small grain. Some are used for hay and pasture, and a few are wooded.

This soil is well suited to corn, soybeans, and small grain. Erosion is the major hazard. Wetness is a problem in some low lying areas. Excess water can be removed by subsurface or surface drains. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface help to control erosion, improve tilth, and increase the organic matter content.

This soil is well suited to many grasses and legumes, such as bromegrass and red clover, for hay and pasture. It is not well suited to alfalfa, however, because of wetness and frost heaving. A drainage system is needed. The drainage in a given area should determine the legumes selected for planting. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The wetness and the shrink-swell potential are moderate limitations if this soil is used as a site for dwellings without basements. The wetness is a severe limitation on sites for dwellings with basements. The dwellings should be constructed without basements, and drains should be installed around the foundations to reduce the wetness. Backfilling around foundations and footings with coarse textured material helps to prevent the structural damage caused by shrinking and swelling. Low strength and frost action are severe limitations on sites for local roads and streets. Roadside ditches help to lower the water table and thus help to prevent frost action. Strengthening or replacing the base material with better suited material improves the ability of the roads and streets to support vehicular traffic.

If this soil is used as a site for septic tank absorption fields, the restricted permeability and the wetness are severe limitations. They can be minimized by filling or mounding with better suited material.

The land capability classification is IIe. The woodland ordination symbol is 5a.

**CfB2—Celina silt loam, stony subsoil, 1 to 6 percent slopes, eroded.** This nearly level to sloping, deep, moderately well drained soil is on uplands. Individual areas are irregular in shape and range from 3 to 160 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 7 inches thick. The subsoil is about 27 inches thick. It has a stone about 15 inches in diameter. It is yellowish brown, mottled, and firm. The upper part is silty clay loam, and the lower part is clay loam. The substratum to a depth of about 60 inches is yellowish brown loam. In some areas the subsoil has less clay. In a few areas it has no large stones. In places the depth to firm glacial till is less than 20 or more than 40 inches.

Included with this soil in mapping are narrow, elongated areas of the somewhat poorly drained Crosby and poorly drained Treaty soils in small drainageways and areas of the well drained Miamian soils on the slightly higher rises and knolls. All of these included soils have a stony subsoil. Also included are many areas on severely eroded knobs where the calcareous till is at or near the surface. Included soils make up about 20 percent of the map unit.

Available water capacity is moderate in the Celina soil. Permeability is moderate or moderately slow. Surface runoff is medium. The seasonal high water table is at a depth of 2.0 to 3.5 feet in winter and early in spring. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for hay or pasture or are wooded.

This soil is well suited to corn, soybeans, and small grain. Erosion is the major hazard. Wetness is a problem in some low lying areas. The coarse fragments in the soil can hinder tillage and in the installation of subsurface drains. Excess water can be removed by subsurface drains. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface help to control erosion, improve or maintain tilth, and increase the organic matter content.

This soil is well suited to many grasses and legumes, such as bromegrass and red clover, for hay and pasture. It is only fairly well suited to alfalfa. A drainage system is needed in some areas. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. The coarse fragments near the surface can hinder haying. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The wetness and the shrink-swell potential are moderate limitations if this soil is used as a site for dwellings without basements. The wetness is a severe limitation on sites for dwellings with basements. The dwellings should be constructed without basements, and drains should be installed around the foundations to reduce the wetness. The coarse fragments in the soil can hinder the installation of tile lines. Backfilling around foundations and footings with coarse textured material helps to prevent the structural damage caused by shrinking and swelling. Low strength and frost action are severe limitations on sites for local roads and streets. Replacing or covering the upper soil layers with suitable base material helps to overcome these limitations.

The wetness, the coarse fragments, and the restricted permeability are limitations if this soil is used as a site for septic tank absorption fields. Subsurface drains can lower the water table, but the coarse fragments can hinder installation of the drains. Filling or mounding with better suited material helps to minimize the restricted permeability.

The land capability classification is IIe. The woodland ordination symbol is 5a.

**CrA—Crosby silt loam, 0 to 3 percent slopes.** This nearly level and gently sloping, deep, somewhat poorly drained soil is on flats on broad moraines and in narrow, meandering drainageways on uplands. Individual areas are irregular in shape. They range from 3 to 200 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown, mottled silt loam about 3 inches thick. The subsoil is about 17 inches thick. The upper part is brown, mottled, firm silt loam and silty clay loam, and the lower part is yellowish brown, mottled clay loam. The substratum to a depth of about 60 inches is brown loam. In some areas the depth to glacial till is more than 40 inches. In a few areas the substratum is sand and gravelly coarse sand. In places the subsoil is less clayey. In some small areas the slope is more than 3 percent. In some areas the silt mantle is as much as 20 inches thick. In some areas south of Cadiz, the soil is stratified with silty and sandy material that is less than 24 or more than 40 inches thick.

Included with this soil in mapping are narrow, elongated areas of poorly drained Cyclone soils in small drainageways. Also included are many small dome-shaped areas of well drained Miamian soils and small areas of severely eroded soils. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Crosby soil. Permeability is slow. Surface runoff is slow in cultivated areas. The seasonal high water table is at a depth of 1 to 3 feet. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for hay or pasture or are wooded.

This soil is well suited to corn, soybeans, and small grain. The wetness is the major limitation. A subsurface drainage system can lower the water table if adequate outlets are available. Many open ditches are used to reduce the wetness. In adequately drained areas, a conservation cropping system dominated by row crops can be used. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface improve or maintain tilth and increase the organic matter content.

This soil is well suited to many grasses and legumes, such as bromegrass and red clover, for hay and pasture. It is not well suited to alfalfa, however, because of wetness and frost heaving. A drainage system is needed. The drainage in a given area should determine the legumes selected for planting. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

This soil is fairly well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The wetness is a severe limitation if this soil is used as a site for dwellings. The dwellings should be constructed without basements, and drains should be installed around the foundations to reduce the wetness. Low strength and frost action are severe limitations on sites for local roads and streets. An adequate drainage system along the roads helps to prevent frost action. The base material should be strengthened or replaced with better suited material.

If this soil is used as a site for septic tank absorption fields, the restricted permeability and the wetness are severe limitations. They can be minimized by filling or mounding with better suited material. Drains around the outer edges of the absorption field help to remove excess water.

The land capability classification is IIw. The woodland ordination symbol is 4a.

**CsA—Crosby silt loam, stony subsoil, 0 to 3 percent slopes.** This nearly level, deep, somewhat poorly drained soil is on broad flats on moraines. Individual areas are irregular in shape and range from 3 to 75 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is about 17 inches of brown, mottled, firm clay loam and loam. It has a stone about 15 inches in diameter. The substratum to a depth of about 60 inches is yellowish

brown, mottled loam. In places the silt mantle is as much as 20 inches thick. In some areas the subsoil is loamy or silty. In other areas it has no large stones.

Included with this soil in mapping are small areas of the sloping, well drained Losantville soils on knolls and along drainageways and small areas of the very poorly drained Treaty soils. Both of these included soils have a stony subsoil. They make up about 9 percent of the map unit.

Available water capacity is moderate in the Crosby soil. Permeability is slow. Surface runoff also is slow. The seasonal high water table is at a depth of 1 to 3 feet in winter and early in spring. Organic matter content is moderate in the surface layer. This layer can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for hay or pasture or are wooded.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. Subsurface drains help to remove excess water. Stones more than 10 inches in diameter can hinder tillage and the installation of subsurface drains. In adequately drained areas, a conservation cropping system dominated by row crops can be used. Cover crops and a system of conservation tillage that leaves protective amounts of crop residue on the surface help to maintain or increase the organic matter content and maintain tilth.

This soil is well suited to grasses and legumes, such as bromegrass and red clover, for hay or pasture. A drainage system is needed. Grazing during wet periods can result in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The wooded areas are not drained. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by cutting, spraying, or girdling.

The wetness is a severe limitation if this soil is used as a site for dwellings. The dwellings should be constructed without basements, and drains should be installed around foundations to reduce the wetness. Low strength and frost action are severe limitations on sites for local roads and streets. Adequate roadside ditches and a more stable base material, such as sand or gravel, are needed.

If this soil is used as a site for septic tank absorption fields, the restricted permeability and the wetness are severe limitations. They can be minimized by filling or mounding with better suited material. Drains around the outer edges of the absorption field help to remove excess water.

The land capability classification is IIw. The woodland ordination symbol is 4a.

**Cy—Cyclone silty clay loam.** This nearly level, deep, poorly drained soil is in broad depressions, swales, and narrow drainageways on glacial till plains. It is subject to ponding. Individual areas are irregular in shape and range from 5 to 320 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is very dark grayish brown silty clay loam about 8 inches thick. The subsurface layer is very dark gray silty clay loam about 4 inches thick. The subsoil is about 48 inches thick. It is mottled and firm. The upper part is dark gray and gray silty clay loam, and the lower part is yellowish brown clay loam. The substratum to a depth of about 80 inches is yellowish brown, mottled loam. In some places the soil has a layer of overwash as much as 20 inches thick. In other places the subsoil is clayey. In some areas the soil is underlain by gravelly loam or sandy loam. In other areas the surface layer is silt loam or loam. In places the soil has less silt throughout.

Included with this soil in mapping are small areas of the somewhat poorly drained Crosby soils on low knolls. These soils make up 5 to 8 percent of the map unit.

Available water capacity is high in the Cyclone soil. Permeability is moderate in the subsoil and moderately slow in the substratum. Surface runoff is very slow or ponded in cultivated areas. The seasonal high water table is near or above the surface in winter and spring. Organic matter content is high in the surface layer. This layer becomes cloddy and hard to work if tilled when wet.

Most areas of this soil are used for cultivated crops. A few are used for pasture, hay, or woodland.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it is suited to intensive row cropping. Excess water can be removed by open ditches, subsurface drains, surface drains, pumps, or a combination of these. A system of conservation tillage that leaves all or part of the crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses, such as reed canarygrass and redtop, and legumes, such as white clover, for hay or pasture. A drainage system is needed. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

This soil is fairly well suited to trees. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. Because the wetness restricts the use of equipment, the trees are usually harvested only during extremely dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation

is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard.

Because the ponding is a severe hazard, this soil is generally unsuited to dwellings and sanitary facilities. Ponding, frost action, and low strength are severe limitations on sites for local roads. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and frost action. Strengthening or replacing the base material with better suited material improves the ability of the roads to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 5w.

**EdA—Eldean silt loam, 0 to 2 percent slopes.** This nearly level, well drained soil is on broad outwash plains and terraces along glacial meltwater streams. It is moderately deep to sand and gravel. Individual areas are irregular in shape and range from 3 to 200 acres in size.

In a typical profile, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is grayish brown loam about 3 inches thick. The subsoil is about 21 inches thick. The upper part is dark brown, firm clay loam and clay; the next part is dark reddish brown, firm sandy clay; and the lower part is dark reddish brown, friable gravelly sandy clay loam. The substratum to a depth of about 60 inches is yellowish brown, loose gravelly coarse loamy sand. In some areas the depth to sand and gravelly coarse sand is more than 40 inches. In other areas the slope is more than 2 percent. In some places the subsoil is loamy throughout. In other places it is loamy sand in the lower part.

Included with this soil in mapping are small areas of the somewhat poorly drained Sleeth soils in the slightly lower landscape positions and small areas of the very poorly drained Westland soils in depressions. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is low in the Eldean soil. Permeability is moderate or moderately slow in the subsoil and rapid in the underlying sand and gravel. Surface runoff is slow. Organic matter content is moderate in the surface layer. This surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodlots.

This soil is well suited to corn, soybeans, and small grain. Droughtiness during dry summer months is the main limitation. The crops can grow well only if the rainfall is well distributed, particularly in the middle of the growing season. The soil is well suited to irrigation. A system of conservation tillage that leaves all or part of the crop residue on the surface, cover crops, green manure crops, and a cropping sequence that includes grasses and legumes help to maintain tilth and the organic matter content and conserve moisture.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture. The grasses and legumes can grow well if rainfall is well distributed. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

A few areas support native hardwoods. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings without basements. Limitations are slight on sites for dwellings with basements. Strengthening foundations and footings and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. Low strength is a severe limitation on sites for local roads and streets. The base material should be strengthened or replaced with better suited material.

A poor filtering capacity is a severe limitation if this soil is used as a site for septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies.

The land capability classification is IIs. The woodland ordination symbol is 4a.

**EdB2—Eldean silt loam, 2 to 6 percent slopes, eroded.** This gently sloping, well drained soil is on the sides of ridges, knolls, and potholes and on the breaks along drainageways on terraces. It is moderately deep to sand and gravel. Individual areas are 5 to 160 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is brown silt loam about 6 inches thick. The subsurface layer is grayish brown loam about 3 inches thick. The subsoil is dark brown, firm clay loam about 26 inches thick. The substratum to a depth of about 60 inches is brown sand and gravelly coarse sand. In some small areas the subsoil contains less clay. In places it is loamy sand in the lower part. In some areas the soil has more than 20 inches of loam glacial till. In other areas the depth to stratified gravel and sand is less than 20 or more than 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Sleeth soils on the slightly lower parts of the landscape and in drainageways. Also included are small areas of the very poorly drained Westland soils in depressions and drainageways and

small areas of severely eroded soils. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is low in the Eldean soil. Permeability is moderate or moderately slow in the subsoil and rapid in the substratum. Surface runoff is medium. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodland. A few are used for orchards.

This soil is well suited to corn, soybeans, and small grain. Erosion and drought are hazards. The crops cannot grow well unless rainfall is well distributed, particularly in the middle of the growing season. The soil is suitable for irrigation. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface help to control erosion, maintain tilth and the organic matter content, and conserve moisture.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture (fig. 5). A cover of grasses and legumes is effective in controlling erosion. These plants can grow well if rainfall is well distributed. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings without basements. Limitations are slight on sites for dwellings with basements. Strengthening foundations and footings and backfilling with coarser textured material help to

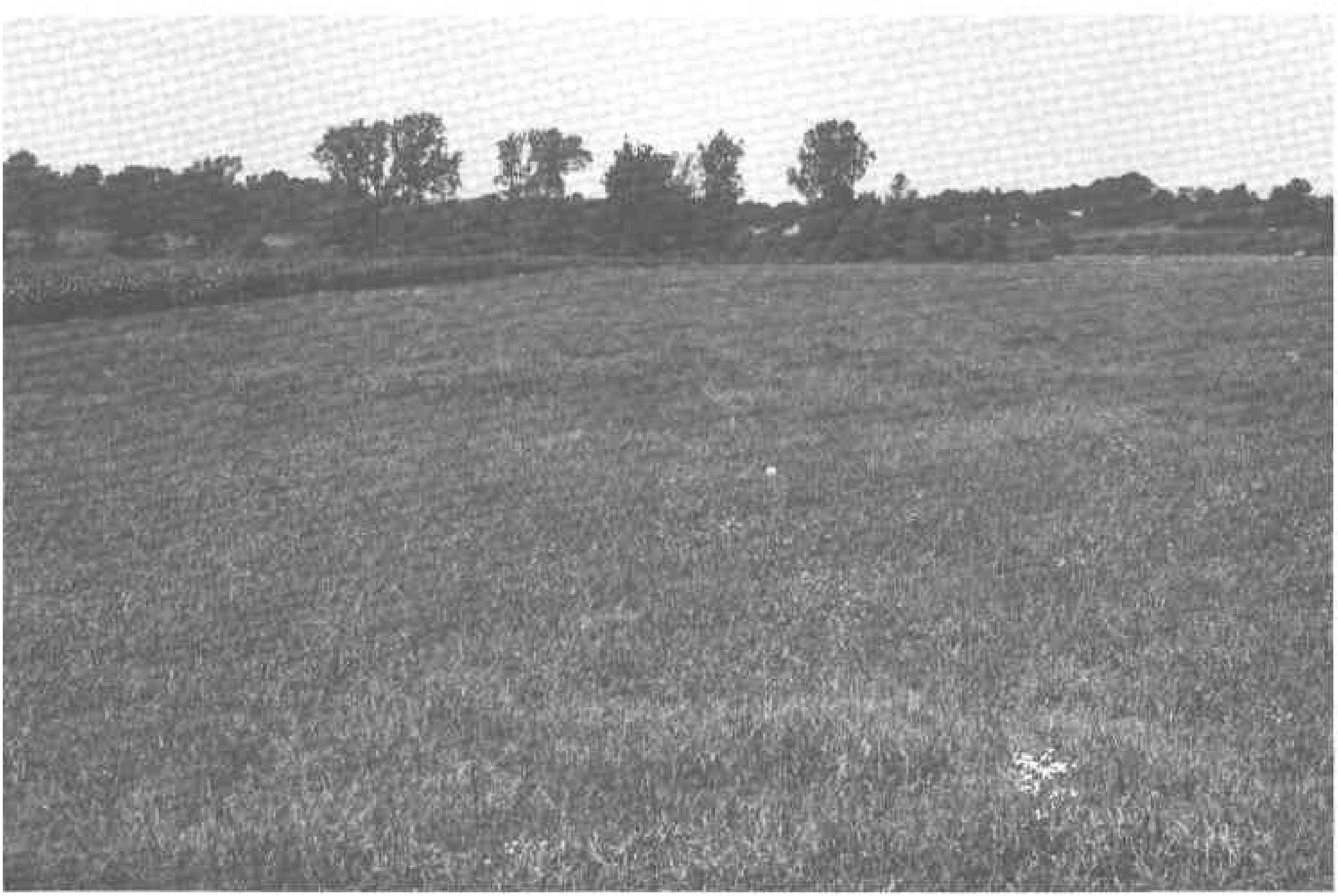


**Figure 5.—Hay and pasture in an area of Eldean silt loam, 2 to 6 percent slopes, eroded.**

prevent the structural damage caused by shrinking and swelling. Low strength is a severe limitation on sites for local roads and streets. The base material should be strengthened or replaced with better suited material.

A poor filtering capacity is a severe limitation if this soil is used as a site for septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies.

The land capability classification is IIe. The woodland suitability subclass is 4a.

**EdC2—Eldean silt loam, 6 to 12 percent slopes, eroded.** This moderately sloping, well drained soil is on the sides of ridges, knolls, and potholes and on the breaks along drainageways on terraces and moraines. It is moderately deep to sand and gravel. Individual areas are irregularly shaped and range from 5 to 20 acres in size.

In a typical profile, the surface layer is brown silt loam about 6 inches thick. The subsoil is about 24 inches thick. The upper part is brown, firm clay loam, and the lower part is dark brown, friable sandy clay loam and gravelly clay loam. The substratum to a depth of about 60 inches is brown, stratified gravel and coarse sand. In some areas the slope is more than 12 or less than 6 percent. In some small areas the subsoil contains less clay. In some places the depth to stratified gravel and sand is less than 20 inches. In other places loam glacial till is at a depth of less than 20 or more than 40 inches.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Sleeth soils in the lower landscape positions. Also included are small areas of severely eroded soils in which the clay loam subsoil is at the surface. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is low in the Eldean soil. Permeability is moderate or moderately slow in the subsoil and rapid in the substratum. Surface runoff is rapid. Organic matter content is moderate in the surface layer. This layer is friable and can be tilled throughout a fairly wide range in moisture content.

Some areas of this soil are used for cultivated crops. Some are used for hay and pasture, and some are used for woodland or orchards.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is a severe hazard. Drought also is a hazard. The crops cannot grow well unless rainfall is well distributed, particularly in the middle of the growing season. A cropping sequence that includes grasses and legumes, diversions, contour farming, grassed waterways, and grade stabilization structures help to control runoff and prevent excessive soil loss. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface help to control erosion, help to maintain tilth and the organic matter content, and conserve moisture.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. These plants can grow well if rainfall is well distributed. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The slope and the shrink-swell potential are moderate limitations if this soil is used as a site for dwellings. Strengthening foundations and footings and backfilling with coarser textured material help to prevent structural damage caused by shrinking and swelling. The dwellings can be designed so that they conform to the natural slope of the land. Revegetating disturbed areas as soon as possible after construction helps to prevent excessive erosion. Low strength is a severe limitation on sites for local roads and streets. The base material should be strengthed or replaced with better suited material.

A poor filtering capacity is a severe limitation if this soil is used as a site for septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies.

The land capability classification is IIIe. The woodland ordination symbol is 4a.

**EdD2—Eldean silt loam, 12 to 18 percent slopes, eroded.** This strongly sloping, well drained soil is on the sides of ridges and knolls and on the breaks along drainageways on terraces and moraines. It is moderately deep to sand and gravel. Individual areas are irregularly shaped and range from 3 to 40 acres in size.

In a typical profile, the surface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is about 23 inches thick of dark yellowish brown and brown, firm clay loam and gravelly clay loam. The substratum to a depth of about 60 inches is yellowish brown, stratified sand and gravelly coarse sand. In some areas the slope is more than 18 or less than 12 percent. In some small areas the subsoil contains less clay. In some places it is loamy sand or sandy loam in the lower part. In other places the depth to stratified sand and gravelly coarse sand is about 15 inches.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Sleeth soils in the lower landscape positions. Also included are small areas of severely eroded soils. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is low in the Eldean soil. Permeability is moderate or moderately slow in the subsoil and rapid in the substratum. Surface runoff is rapid. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used as woodland. Some are used for grasses and legumes for forage or pasture. Very little of the acreage is used for cultivated crops.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the main hazard. The slope is a limitation. A system of conservation tillage that leaves all or part of the crop residue on the surface, diversions, grassed waterways, and cover crops help to prevent excessive soil loss. A crop rotation dominated by grasses and legumes is effective in reducing the runoff rate and in controlling erosion.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for forage and pasture. Some areas have a permanent grass cover because of the difficulty in establishing seedlings. In some areas gullies have formed. Farm machinery cannot easily cross these areas. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concerns are the erosion hazard, the equipment limitation, and plant competition. Because of the erosion hazard and the equipment limitation, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The slope is a severe limitation if this soil is used as a site for dwellings. The dwellings should be designed so that they conform to the natural slope of the land. Land shaping and installing retaining walls also help to overcome the slope. Because of the erosion hazard, the existing vegetation should be disturbed as little as possible during construction and those areas that are disturbed should be revegetated as soon as possible. Low strength and the slope are severe limitations on sites for local roads and streets. Cutting and filling are needed, and the roads should be built on the contour if possible. Strengthening or replacing the base material with better suited material improves the ability of the roads and streets to support vehicular traffic.

A poor filtering capacity and the slope are severe limitations if this soil is used as a site for septic tank absorption fields. Installing the absorption field on the contour helps to overcome the slope. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies.

The land capability classification is IVe. The woodland ordination symbol is 4r.

**EdE2—Eldean silt loam, 18 to 35 percent slopes, eroded.** This moderately steep and steep, well drained soil is on the sides of ridges and knolls and on the breaks along drainageways on terraces and moraines. It is moderately deep to sand and gravel. Individual areas are irregularly shaped and range from 3 to 20 acres in size.

In a typical profile the surface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is dark yellowish brown and brown, firm clay loam about 19 inches thick. The substratum to a depth of about 60 inches is yellowish brown, stratified sand and gravelly coarse sand. In some areas the slope is more than 35 or less than 18 percent. In some small areas the subsoil contains less sand. In some places it is loamy sand or sandy loam in the lower part. In other places the depth to stratified sand and gravelly coarse sand is about 14 inches.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Sleeth soils in drainageways and other low landscape positions. These soils make up 2 to 5 percent of the map unit.

Available water capacity is low in the Eldean soil. Permeability is moderate or moderately slow in the subsoil and rapid in the substratum. Surface runoff is rapid or very rapid. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used as woodland. Some are used for grasses and legumes for forage or pasture. Very little of the acreage is used for cultivated crops. This soil is generally unsuited to cultivated crops because of a very serve hazard of further erosion.

This soil is poorly suited to grasses and legumes for forage or pasture. Operating farm machinery is difficult because of the slope. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concerns are the erosion hazard, the equipment limitation, and plant competition. Because of the erosion hazard, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on these slopes. Special logging methods, such as yarding logs uphill with a cable, may be needed to minimize the use of this equipment. Seedlings survive

and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because the slope is a severe limitation, this soil is generally unsuited to dwellings and sanitary facilities. Slope and low strength are severe limitations on sites for local roads and streets. Cutting and filling may be needed, and the roads should be built on the contour if possible. The base material should be strengthened or replaced with better suited material. Because of erosion hazard, the existing vegetation should be disturbed as little as possible during road construction. The areas that are disturbed should be revegetated as soon as possible.

The land capability classification is VIe. The woodland ordination symbol is 4r.

**ExC3—Eldean clay loam, 6 to 12 percent slopes, severely eroded.** This moderately sloping, well drained soil is on the sides of ridges, knolls, and potholes and on the breaks along drainageways on terraces and moraines. It is moderately deep to sand and gravel. Individual areas are irregularly shaped and range from 3 to 40 acres in size.

In a typical profile, the surface layer is brown clay loam about 5 inches thick. The subsoil is about 27 inches thick. The upper part is dark yellowish brown, firm clay loam, and the lower part is dark brown and strong brown, firm clay loam and sandy clay loam. The substratum to a depth of about 60 inches is brown, stratified sand and gravelly coarse sand. In places the slope is more than 12 or less than 6 percent. In some small areas the subsoil contains less clay. In some areas loam glacial till is at a depth of less than 20 or more than 40 inches. In other areas the lower part of the subsoil is loamy sand or sandy loam. In places the depth to stratified sand and gravel is less than 20 inches.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Sleeth soils in the lower landscape positions. Also included are small areas of uneroded soils. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is low in the Eldean soil. Permeability is moderate or moderately slow in the subsoil and rapid in the substratum. Surface runoff is rapid. Organic matter content is moderate in the surface layer. This layer is firm. Tilling within the proper range of moisture content helps to prevent compaction and clodding.

Some areas of this soil are used for cultivated crops. Some are used for hay and pasture, and some are used for woodland or orchards.

This soil is poorly suited to corn, soybeans, and small grain because of a very severe hazard of further erosion. Drought also is a hazard. The crops cannot grow well unless rainfall is well distributed, particularly in the middle of the growing season. A cropping sequence that includes grasses and legumes, a system of conservation tillage that leaves all or part of the crop residue on the surface, diversions, contour farming, grassed waterways, and grade stabilization structures help prevent excessive soil loss. Cover crops also help to control erosion and improve or maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes, such as bromegrasses and alfalfa, for forage and pasture. A cover of grasses and legumes is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The slope and the shrink-swell potential are moderate limitations if this soil is used as a site for dwellings without basements. The slope is a moderate limitation on sites for dwellings with basements. Strengthening foundations and footings and backfilling with coarser textured material help to prevent structural damage caused by shrinking and swelling. The dwellings can be designed so that they conform to the natural slope of the land. Revegetating disturbed areas as soon as possible after construction helps to prevent excessive erosion. Low strength is a severe limitation on sites for local roads and streets. The base material should be strengthened or replaced with better suited material.

A poor filtering capacity is a severe limitation if this soil is used as a site for septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies.

The land capability classification is IVe. The woodland ordination symbol is 4a.

**ExD3—Eldean clay loam, 12 to 18 percent slopes, severely eroded.** This strongly sloping, well drained soil is on the sides of ridges and knolls and on the breaks along drainageways on terraces and moraines. It is moderately deep to sand and gravel. Individual areas are irregularly shaped and range from 5 to 50 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is brown clay loam about 3 inches thick. The subsoil is brown, firm clay loam about 17 inches thick. The substratum to a depth of about 60 inches is yellowish brown, stratified sand and gravelly coarse sand. In places the slope is more than 18 or less than 12 percent. In some small areas the subsoil contains less clay. In some areas the surface layer is loam, and in some of these areas it is

redder. In places the depth to stratified sand and gravelly coarse sand is about 15 inches.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Sleeth soils in drainageways and other low landscape positions. These soils make up 2 to 5 percent of the map unit.

Available water capacity is low in the Eldean soil. Permeability is moderate or moderately slow in the subsoil and rapid in the substratum. Surface runoff is rapid in cultivated areas. Organic matter content is moderate in the surface layer. This layer is firm. Tilling within the proper range of moisture content helps to prevent compaction and clodding.

Most areas are used as woodland. Some are used for grasses and legumes for forage or pasture. Very little of the acreage is used for cultivated crops. This soil is generally unsuited to cultivated crops because of a very severe hazard of further erosion. Operating most types of farm machinery is difficult because of the slope.

This soil is poorly suited to grasses and legumes, such as bromegrass and alfalfa, for forage and pasture. Some areas have a permanent grass cover because of the difficulty in establishing seedlings. In some areas gullies have formed. Farm machinery cannot easily cross these areas. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concerns are the erosion hazard, the equipment limitation, and plant competition. Because of the erosion hazard and the equipment limitation, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The slope is a severe limitation if this soil is used as a site for dwellings. The dwellings should be designed so that they conform to the natural slope of the land. Land shaping and installing retaining walls also help to overcome the slope. Because of the erosion hazard, the existing vegetation should be disturbed as little as possible during construction. Those areas that are disturbed should be revegetated as soon as possible. Low strength and the slope are severe limitations on sites for local roads and streets. Cutting and filling may be needed, and the roads should be built on the contour if possible. Strengthening or replacing the base material with better suited material improves the ability of the roads and streets to support vehicular traffic.

A poor filtering capacity and the slope are severe limitations if this soil is used as a site for septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Installing the absorption field on the contour helps to overcome the slope.

The land capability classification is VIe. The woodland ordination symbol is 4r.

**Ge—Genesee loam, occasionally flooded.** This nearly level, deep, well drained soil is on flood plains. Individual areas are irregularly shaped on the broad flood plains and long and narrow in the valleys of the smaller streams. They range from 3 to 80 acres in size.

In a typical profile, the surface layer is dark grayish brown loam about 7 inches thick. The subsurface layer also is dark grayish brown loam. It is about 10 inches thick. The subsoil is dark grayish brown and dark brown, friable loam about 20 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, friable, stratified loam and sandy loam. In some areas the surface soil and subsoil are sandy. In a few areas the subsoil is browner. In places sand and gravelly coarse sand are within a depth of 60 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Shoals soils in the slightly lower landscape positions and the very poorly drained Sloan soils in depressions and drainageways. Included soils make up 2 to 5 percent of the map unit.

Available water capacity is very high in the Genesee soil. Permeability is moderate. Surface runoff is slow. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are wooded. Very few areas are used for pasture or hay.

This soil is well suited to corn and soybeans but is poorly suited to small grain. Late planting or replanting is sometimes necessary because of flooding in the spring. Winter cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface help to maintain or increase the organic matter content and help to maintain good tilth.

This soil is well suited to grasses and legumes for hay or pasture. The flooding is a slight hazard. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Restricted grazing during wet periods, proper stocking rates, and pasture rotation help to keep the pasture in good condition.

A few small areas support native hardwoods. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because the flooding is a severe hazard, this soil is generally unsuited to dwellings and sanitary facilities. The flooding also is a severe hazard on sites for local roads. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and

culverts help to prevent the damage caused by flooding, frost action, and low strength.

The land capability classification is IIw. The woodland ordination symbol is 8a.

**La—Landes loam, rarely flooded.** This nearly level, deep, well drained soil is on bottom land along streams. Individual areas are elongated and range from 10 to 100 acres in size.

In a typical profile, the surface layer is very dark grayish brown loam about 9 inches thick. The subsurface layer also is very dark grayish brown loam. It is about 14 inches thick. The subsoil is yellowish brown, friable loam about 16 inches thick. The upper part of the substratum is yellowish brown, mottled fine sandy loam. The lower part to a depth of about 60 inches is brown gravelly loamy coarse sand. In places the dark surface soil is as much as 24 inches thick. In some small areas the surface soil and subsoil are silty. In some areas the soil is grayer throughout.

Included with this soil in mapping are small areas of the well drained Losantville and Miamian soils on the higher parts of the landscape. These soils are more clayey than the Landes soil. They make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Landes soil. Permeability is moderate in the surface soil and subsoil and rapid in the substratum. Surface runoff is slow. Organic matter content is high in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are wooded or pastured.

This soil is well suited to corn, soybeans, and small grain. The major hazard is drought during the midsummer months. A system of conservation tillage that leaves protective amounts of crop residue on the surface helps to maintain the organic matter content and good tilth and conserves moisture.

This soil is well suited to hay and pasture. It is suited to deep rooted legumes. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Restricted grazing during wet periods, proper stocking rates, and pasture rotation help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Also, the seasonal flooding and the overflow channels can hinder tree planting or harvesting. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the flooding and a poor filtering capacity, this soil is generally unsuited to dwellings and sanitary facilities. Flooding and frost action are hazards on sites for local roads. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by flooding and frost action.

The land capability classification is IIs. The woodland ordination symbol is 7a.

**LeB2—Losantville silt loam, 2 to 6 percent slopes, eroded.** This gently sloping, deep, well drained soil is on rises on glacial till plains and in areas along drainageways and streams. Individual areas are irregular in shape and range from 5 to 100 acres in size. The dominant size is about 25 acres.

In a typical profile, the surface layer is brown silt loam about 7 inches thick. The subsoil is dark yellowish brown, firm clay about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam that contains free carbonates. In some places the surface layer consists mainly of material from the substratum. In other places the lower part of the subsoil is stratified with sandy loam, loamy sand, and sandy clay loam. In some areas the depth to loam glacial till is more than 22 inches. In a few places the substratum is sand and gravel within a depth of 60 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Crosby soils in the lower landscape positions. Also included are areas where free carbonates are at the surface. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Losantville soil. Permeability is moderate or moderately slow in the subsoil and slow in the substratum. Surface runoff is medium. The seasonal high water table is at a depth of 4 to 6 feet in winter and early in spring. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodland.

This soil is well suited to corn, soybeans, and small grain. Erosion is the main hazard. A cropping sequence that includes grasses and legumes, a system of conservation tillage that leaves all or part of the crop residue on the surface, diversions, contour farming, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops also help to control erosion and improve or maintain tilth and the organic matter content. Subsurface tile is needed in seepy areas in some drainageways and swales.

A cover of grasses and legumes, such as bromegrass and alfalfa, for hay or pasture is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

A few areas are wooded. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, and girdling.

Limitations are slight if this soil is used as a site for dwellings without basements, but the wetness is a moderate limitation on sites for dwellings with basements. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser textured material and installing foundation drains help to prevent the structural damage caused by wetness. Frost action is a moderate limitation on sites for local roads and streets. It can be controlled by replacing or covering the upper soil layers with suitable base material.

If this soil is used as a site for septic tank absorption fields, the restricted permeability and the wetness are limitations. They can be minimized by filling or mounding with better suited material.

The land capability classification is IIe. The woodland ordination symbol is 4a.

**LeC2—Losantville silt loam, 6 to 12 percent slopes, eroded.** This moderately sloping, deep, well drained soil is on rises on glacial till plains and moraines and on long slope breaks along streams and drainageways. Individual areas are generally elongated or irregularly shaped and range from 3 to 80 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 13 inches thick. The upper part is dark grayish brown, friable loam, and the lower part is dark yellowish brown and yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown loam glacial till that contains free carbonates. In places the substratum is sand and gravel within a depth of 60 inches. In some areas the depth to the substratum is less than 12 or more than 22 inches. In other areas the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Crosby soils on the tops of low ridges. Also included are many small areas of severely eroded soils in which the clay loam subsoil is exposed. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Losantville soil. Permeability is moderate or moderately slow in the subsoil and slow in the substratum. Surface runoff is rapid in cultivated areas. The seasonal high water table is at a depth of 4 to 6 feet in winter and early in spring. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Some areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the main hazard. A cropping sequence that includes grasses and legumes, a system of conservation tillage that leaves all or part of the crop residue on the surface, diversions, contour farming, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops also help to control erosion and improve or maintain tilth and the organic matter content. Subsurface tile is needed in seepy areas in some drainageways.

A cover of grasses and legumes, such as bromegrass and alfalfa, for hay and pasture is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The slope and the wetness are moderate limitations if this soil is used as a site for dwellings. The dwellings should be designed so that they conform to the natural slope of the land. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser textured material and installing foundation drains help to prevent the structural damage caused by wetness. Because of the erosion hazard, the existing vegetation should be disturbed as little as possible during construction and those areas that are disturbed should be revegetated as soon as possible. The slope and frost action are moderate limitations on sites for local roads and streets. Constructing the roads on contour and land shaping help to overcome the slope. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material.

If this soil is used as a site for septic tank absorption fields, the restricted permeability and the wetness are limitations. They can be minimized by filling or mounding with better suited material. If the disposal system is poorly designed, seepage on top of the till can move laterally several feet before surfacing.

The land capability classification is IIIe. The woodland ordination symbol is 4a.

**LeD2—Losantville silt loam, 12 to 18 percent slopes, eroded.** This strongly sloping, deep, well drained soil is on irregularly shaped knolls and narrow, elongated breaks along drainageways and depressions on moraines. Individual areas range from 3 to 40 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is about 16 inches of dark grayish brown, dark yellowish brown, and brown, friable and firm loam and clay loam. The substratum to a depth of about 60 inches is yellowish brown loam glacial till that contains free carbonates. In places the substratum is sand and gravel within a depth of 60 inches. In some areas the slope is less than 12 or more than 18 percent. In other areas the depth to the substratum is less than 12 or more than 22 inches.

Included with this soil in mapping are many small areas of severely eroded soils in which the clay loam subsoil is exposed. These soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Losantville soil. Permeability is moderate or moderately slow in the subsoil and slow in the substratum. Surface runoff is rapid in cultivated areas. The seasonal high water table is at a depth of 4 to 6 feet in winter and early in spring. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Some areas of this soil are wooded. Others are used for grasses and legumes for forage or pasture. Very little of the acreage is used for cultivated crops.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the main hazard. A system of conservation tillage that leaves all or part of the crop residue on the surface, diversions, grassed waterways, and cover crops help to prevent excessive soil loss. Crop rotations dominated by grasses and legumes are effective in reducing the runoff rate and in controlling erosion.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for forage and pasture. Some areas have a permanent grass cover because of the difficulty in establishing seedlings. In some areas gullies have formed. Farm machinery cannot easily cross these areas. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concerns are the erosion hazard, the equipment limitation, seedling mortality, and plant competition. Because of the erosion hazard and the equipment limitation, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The slope is a severe limitation if this soil is used as a site for dwellings. The dwellings should be designed so that they conform to the natural slope of the land. Because of the erosion hazard, the existing vegetation should be disturbed as little as possible during construction and those areas that are disturbed should be revegetated as soon as possible. The slope is a severe limitation on sites for local roads and streets. It can be overcome by building on the contour and by land shaping.

The restricted permeability and the slope are severe limitations if this soil is used as a site for septic tank absorption fields. Filling or mounding with better suited material helps to minimize the restricted permeability. Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly.

The land capability classification is IVe. The woodland ordination symbol is 4r.

**LeE2—Losantville silt loam, 18 to 30 percent slopes, eroded.** This moderately steep and steep, deep, well drained soil is on irregularly shaped knolls and narrow, elongated breaks along drainageways and depressions on moraines. Individual areas range from 5 to 80 acres in size.

In a typical profile, the surface layer is brown, friable silt loam about 3 inches thick. The subsoil is dark yellowish brown, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam glacial till. In places the substratum is sand and gravel within a depth of 60 inches. In some areas the slope is less than 18 or more than 30 percent. In some areas the depth to the substratum is less than 12 or more than 22 inches.

Included with this soil in mapping are many small areas of severely eroded soils in which the clay loam subsoil is exposed. These soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Losantville soil. Permeability is moderate or moderately slow in the subsoil and slow in the substratum. Surface runoff is rapid or very rapid. The seasonal high water table is at a depth of 4 to 6 feet in winter and early in spring. Organic matter content is moderate in the surface layer. Tilling within the proper range of moisture content helps to prevent compaction and clodding.

Most areas are used for grasses and legumes for forage or pasture. Some are wooded. This soil is generally unsuitable for corn, soybeans, and small grain, mainly because of the hazard of further erosion.

This soil is fairly well suited to grasses and legumes for forage or pasture. Operating farm machinery is difficult because of the slope. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concerns are the erosion hazard, the equipment limitation, seedling mortality, and plant competition. Because of the erosion hazard, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on these slopes. Seedlings survive and grow well if competing vegetation

is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because the slope and the restricted permeability are severe limitations, this soil is generally unsuitable as a site for dwellings and sanitary facilities. The slope is a severe limitation on sites for local roads. It can be overcome by building on the contour and by land shaping. Because of the erosion hazard, the existing vegetation should be disturbed as little as possible during road construction and those areas that are disturbed should be revegetated as soon as possible.

The land capability classification is VIe. The woodland ordination symbol is 4r.

**LhC3—Losantville clay loam, 6 to 12 percent slopes, severely eroded.** This moderately sloping, deep, well drained soil is on irregularly shaped knolls and narrow, elongated breaks along drainageways and depressions on upland till plains. Individual areas range from 3 to 80 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is mixed dark grayish brown and dark yellowish brown clay loam about 4 inches thick. The subsoil is dark yellowish brown, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam glacial till. In some of the less eroded areas, the surface layer is silt loam and is mixed with material from the upper part of the subsoil. In places the substratum is sand and gravel within a depth of 60 inches. In some areas the slope is more than 12 or less than 6 percent. In other areas the depth to the substratum is less than 12 or more than 22 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Crosby soils in the lower landscape positions. These soils make up 3 to 5 percent of the map unit.

Available water capacity is moderate in the Losantville soil. Permeability is moderate or moderately slow in the subsoil and slow in the substratum. Surface runoff is rapid in cultivated areas. The seasonal high water table is at a depth of 4 to 6 feet in winter and early in spring. Organic matter content is moderate or low in the surface layer. This layer is firm. Tilling within the proper range of moisture content helps to prevent compaction and clodding.

Some areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the main hazard. Measures that control runoff and help to prevent excessive soil loss are needed. Examples are a cropping sequence that includes grasses and legumes, a system of conservation tillage that leaves all or part of the crop residue on the surface, diversions, contour farming, grassed waterways, grade stabilization structures, and cover crops. More than one of these measures generally are needed. Cover crops help to maintain tilth and the organic matter content.

A cover of grasses and legumes, such as bromegrass and alfalfa, for hay and pasture is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The slope and the wetness are moderate limitations if this soil is used as a site for dwellings. The dwellings should be designed so that they conform to the natural slope of the land. Foundations, footings and basement walls should be strengthened. Backfilling with coarser textured material and installing foundation drains help to prevent the structural damage caused by wetness. Revegetating disturbed areas as soon as possible after construction helps to control erosion. The slope and frost action are moderate limitations on sites for local roads and streets. Constructing the roads on the contour and land shaping help to overcome the slope. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material.

The restricted permeability and the wetness are limitations if this soil is used as a site for septic tank absorption fields. Filling or mounding with better suited material helps to minimize these limitations. If the disposal system is poorly designed, seepage on top of the till can move laterally several feet before surfacing.

The land capability classification is IVe. The woodland ordination symbol is 4a.

**LhD3—Losantville clay loam, 12 to 18 percent slopes, severely eroded.** This strongly sloping, deep, well drained soil is on irregularly shaped knolls and narrow, elongated breaks along drainageways and depressions on moraines. Individual areas range from 3 to 80 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is mixed dark grayish brown and dark yellowish brown clay loam about 3 inches thick. The subsoil is dark brown and dark yellowish brown, firm clay loam about 15 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam glacial till. In some areas the slope is less than 12 or more than 18 percent. In some of the less eroded areas, the surface layer is silt loam or loam and is surface soil material mixed with material from the upper part of the subsoil. In some places the substratum is sand and gravel within a depth of 60 inches. In other places the depth to the substratum is less than 12 or more than 22 inches.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Crosby soils in

drainageways and in the lower landscape positions. Also included are a few small areas of soils that are not eroded. Included soils make up 2 to 5 percent of the map unit.

Available water capacity is moderate in the Losantville soil. Permeability is moderate or moderately slow in the subsoil and slow in the substratum. Surface runoff is very rapid in cultivated areas. The seasonal high water table commonly is at a depth of 4 to 6 feet in winter and early in spring. Organic matter content is moderate or low in the surface layer. It has been reduced by erosion. The surface layer is firm. Tilling within the proper range of moisture content helps to prevent compaction and clodding.

Some areas are wooded. Some are used for grasses and legumes for forage or pasture. Very little of the acreage is used for cultivated crops. This soil is generally unsuitable for corn, soybeans, and small grain, mainly because of the hazard of further erosion. Operating most types of farm machinery is difficult because of the slope.

This soil is fairly well suited to grasses and legumes, such as bromegrass and alfalfa, for forage and pasture. Some areas have a permanent grass cover because of the difficulty in establishing seedlings. In some areas gullies have formed. Farm machinery cannot easily cross these areas. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concerns are the erosion hazard, the equipment limitation, seedling mortality, and plant competition. Because of the erosion hazard and the equipment limitation, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The slope is a severe limitation if this soil is used as a site for dwellings. The dwellings should be designed so that they conform to the natural slope of the land. Because of the erosion hazard, the existing vegetation should be disturbed as little as possible during construction and those areas that are disturbed should be revegetated as soon as possible. The slope is a severe limitation on sites for local roads and streets. It can be overcome by building on the contour and by land shaping.

The restricted permeability and the slope are severe limitations if this soil is used as a site for septic tank absorption fields. Filling or mounding with better suited material helps to minimize the restricted permeability. Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly.

The land capability classification is VIe. The woodland ordination symbol is 4r.

**LsB2—Losantville silt loam, stony subsoil, 2 to 6 percent slopes, eroded.** This gently sloping, deep, well drained soil is on rises on glacial till plains and in areas along drainageways and streams. Individual areas are irregular in shape and range from 5 to 100 acres in size. The dominant size is about 25 acres.

In a typical profile, the surface layer is mixed brown and dark yellowish brown silt loam about 5 inches thick. The subsoil is firm clay loam 15 inches thick. It has a stone about 12 inches in diameter. It is dark yellowish brown in the upper part and brown and mottled in the lower part. The substratum to a depth of about 60 inches is brown loam that contains free carbonates. In some places the surface layer consists mainly of material from the substratum. In other places the lower part of the subsoil is stratified with sandy loam, loamy sand, and sandy clay loam. In some areas the depth to loam glacial till is more than 22 inches. In a few places the subsoil has no large stones. In places the substratum is sand and gravel within a depth of 60 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Crosby soils in the lower lying landscape positions. Also included are areas where free carbonates are at the surface. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Losantville soil. Permeability is moderate or moderately slow in the subsoil and slow in the substratum. Surface runoff is medium. The seasonal high water table is commonly at a depth of 4 to 6 feet in winter and early in spring. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content. Stones more than 10 inches in diameter are near the surface. They can hinder tillage.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodland.

This soil is well suited to corn, soybeans, and small grain. Erosion is the main hazard. A cropping sequence that includes grasses and legumes, a system of conservation tillage that leaves all or part of the crop residue on the surface, diversions, contour farming, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops also help to control erosion and improve or maintain tilth and the organic matter content. Subsurface tile is needed in seepy areas in some drainageways and swales.

A cover of grasses and legumes, such as bromegrass and alfalfa, for hay and pasture is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, and timely

deferment of grazing help to keep the pasture in good condition.

A few areas are wooded. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, and girdling.

Limitations are slight if this soil is used as a site for dwellings without basements, but the wetness is a moderate limitation on sites for dwellings with basements. Backfilling with coarser textured material and installing foundation drains help to prevent the structural damage caused by wetness. Frost action is a moderate limitation on sites for local roads and streets. The base material should be strengthened or replaced with better suited material.

If this soil is used as a site for septic tank absorption fields, the restricted permeability and the wetness are limitations. They can be minimized by filling or mounding with better suited material. If the disposal system is poorly designed, seepage on top of the till can move laterally several feet before surfacing.

The land capability classification is IIe. The woodland ordination symbol is 4a.

**LsC2—Losantville silt loam, stony subsoil, 6 to 12 percent slopes, eroded.** This moderately sloping, deep, well drained soil is on rises on glacial till plains and moraines and on long slope breaks along streams and drainageways. Individual areas are generally elongated or irregularly shaped and range from 3 to 80 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is dark yellowish brown, firm clay loam about 15 inches thick. It has a stone about 12 inches in diameter. The substratum to a depth of about 60 inches is yellowish brown loam glacial till that contains free carbonates. In some areas the substratum is sand and gravel at a depth of about 60 inches. In other areas the depth to the substratum is less than 12 or more than 22 inches. In a few places the subsoil has no large stones. In places the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Crosby soils on ridgetops. Also included are many small areas of severely eroded soils in which the clay loam subsoil is exposed. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Losantville soil. Permeability is moderate or moderately slow in the subsoil and slow in the substratum. Surface runoff is medium in cultivated areas. The seasonal high water table is commonly at a depth of 4 to 6 feet in winter and early in spring. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content. Stones more than 10 inches in diameter are near the surface. They can hinder tillage.

Some areas of this soil are used for cultivated crops along with the less sloping Losantville soils. Some areas are used for hay, pasture, or woodland.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the main hazard. A cropping sequence that includes grasses and legumes, a system of conservation tillage that leaves all or part of the crop residue on the surface, diversions, contour farming, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops also help to control erosion and improve or maintain tilth and the organic matter content. Subsurface drains are needed in seepy areas in some drainageways.

A cover of grasses and legumes, such as bromegrass and alfalfa, for hay and pasture is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The slope and the wetness are moderate limitations if this soil is used as a site for dwellings. The dwellings should be designed so that they conform to the natural slope of the land. Foundations and footings should be strengthened. Backfilling with coarser textured material and installing foundation drains help to prevent the structural damage caused by wetness. Frost action and the slope are moderate limitations on sites for local roads and streets. The base material should be strengthened or replaced with better suited material. Constructing the roads on the contour and land shaping help to overcome the slope.

The restricted permeability and the slope are limitations if this soil is used as a site for septic tank absorption fields. Filling or mounding with better suited material helps to minimize these limitations. If the disposal system is poorly designed, seepage on top of the till can move laterally several feet before surfacing.

The land capability classification is IIIe. The woodland ordination symbol is 4a.

**LsD2—Losantville silt loam, stony subsoil, 12 to 18 percent slopes, eroded.** This strongly sloping, deep, well drained soil is on irregularly shaped knolls and narrow, elongated breaks along drainageways and depressions on moraines. Individual areas range from 3 to 40 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is mixed dark grayish brown and dark yellowish brown silt loam about 3 inches thick. The subsoil is dark yellowish brown, firm clay loam about 16 inches thick. It has a stone about 14 inches in diameter. The substratum to a depth of about 60 inches is yellowish brown loam glacial till that

contains free carbonates. In some areas the slope is less than 12 or more than 18 percent. In other areas the substratum is sand and gravel at a depth of about 60 inches. In some small areas the depth to the substratum is less than 12 or more than 22 inches. In a few places the subsoil has no large stones.

Included with this soil in mapping are areas of the somewhat poorly drained Crosby soils in drainageways. Also included are many small areas of severely eroded soils in which the clay loam subsoil is exposed. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Losantville soil. Permeability is moderate or moderately slow in the subsoil and slow in the substratum. Surface runoff is rapid in cultivated areas. The seasonal high water table is commonly at a depth of 4 to 6 feet in winter and early in spring. Organic matter content is moderate or low in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content. Stones more than 10 inches in diameter are near the surface. They can hinder tillage.

Some areas of this soil are wooded. Some are used for grasses and legumes for forage or pasture. Very little of the acreage is used for cultivated crops.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the main hazard. A system of conservation tillage that leaves all or part of the crop residue on the surface, diversions, grassed waterways, and cover crops help to prevent excessive soil loss. Crop rotations dominated by grasses and legumes are effective in reducing the runoff rate and in controlling erosion.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for forage and pasture. Some areas have a permanent grass cover because of the difficulty in establishing seedlings. In some areas gullies have formed. Farm machinery cannot easily cross these areas. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concerns are the erosion hazard, the equipment limitation, seedling mortality, and plant competition. Because of the erosion hazard and the equipment limitation, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The slope is a severe limitation if this soil is used as a site for dwellings. The dwellings should be designed so that they conform to the natural slope of the land. Land shaping and installing retaining walls also help to overcome the slope. Because of the erosion hazard, the existing vegetation should be disturbed as little as possible during construction and those areas that are disturbed should be revegetated as soon as possible. The slope is a severe limitation on sites for local roads and streets. It can be overcome by building on the contour and by land shaping.

The restricted permeability and the slope are severe limitations if this soil is used as a site for septic tank absorption fields. Filling or mounding with better suited material help to minimize the restricted permeability. Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly.

The land capability classification is IVe. The woodland ordination symbol is 4r.

**LsE2—Losantville silt loam, stony subsoil, 18 to 30 percent slopes, eroded.** This moderately steep and steep, deep, well drained soil is on irregularly shaped knolls and narrow, elongated breaks along drainageways and depressions on moraines. Individual areas range from 5 to 80 acres in size.

In a typical profile, the surface layer is brown silt loam about 3 inches thick. The subsoil is dark yellowish brown, firm clay loam about 10 inches thick. It has a stone about 12 inches in diameter. The substratum to a depth of about 60 inches is yellowish brown loam glacial till. In some areas the substratum is sand and gravel within a depth of 60 inches. In other areas the depth to the substratum is less than 12 or more than 22 inches. In some places the subsoil has no large stones. In other places the slope is less than 18 or more than 30 percent.

Included with this soil in mapping are many small areas of severely eroded soils in which the clay loam subsoil is exposed. Also included are some areas of the somewhat poorly drained Crosby soils in drainageways. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Losantville soil. Permeability is moderate or moderately slow in the subsoil and slow in the substratum. Surface runoff is very rapid. The seasonal high water table is commonly at a depth of 4 to 6 feet in winter and early in spring. Organic matter content is moderate or low in the surface layer. Tilling within the proper range of moisture content helps to prevent compaction and clodding. Stones more than 10 inches in diameter are near the surface. They can hinder tillage.

Most of the acreage is used for grasses and legumes for forage and pasture. Some areas are wooded. This soil is generally unsuitable for corn, soybeans, and small grain, mainly because of the hazard of further erosion.

This soil is fairly well suited to grasses and legumes, such as bromegrass and alfalfa, for forage and pasture. Operating farm machinery is difficult because of the slope. Overgrazing or grazing when the soil is wet

causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concerns are the erosion hazard, the equipment limitation, seedling mortality, and plant competition. Because of the erosion hazard, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on these slopes. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

Because the slope is a severe limitation, this soil is generally unsuitable as a site for dwellings. Local roads should be built on the contour where possible. Because of the erosion hazard, the existing vegetation should be disturbed as little as possible during road construction and those areas that are disturbed should be revegetated as soon as possible.

The land capability classification is VIe. The woodland ordination symbol is 4r.

**LxC3—Losantville clay loam, stony subsoil, 6 to 12 percent slopes, severely eroded.** This moderately sloping, deep, well drained soil is on irregularly shaped knolls and narrow, elongated breaks along drainageways and depressions on moraines. Individual areas range from 3 to 80 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is yellowish brown clay loam about 3 inches thick. The subsoil is yellowish brown, firm clay loam about 9 inches thick. It has a stone about 12 inches in diameter. The substratum to a depth of about 60 inches is yellowish brown loam glacial till. In some of the less eroded areas, the surface layer is silt loam or loam and is surface soil material mixed with material from the upper part of the subsoil. In some areas the substratum is sand and gravel within a depth of 60 inches. In other areas the subsoil has no large stones. In some places the slope is more than 12 or less than 6 percent. In other places the depth to the substratum is less than 12 or more than 22 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Crosby soils in the lower landscape positions and in drainageways. These soils make up 3 to 5 percent of the map unit.

Available water capacity is moderate in the Losantville soil. Permeability is moderate or moderately slow in the subsoil and slow in the substratum. Surface runoff is rapid in the cultivated areas. The seasonal high water table is commonly at a depth of 4 to 6 feet in winter and early in spring. Organic matter content is low in the surface layer. This layer is firm. Tilling within the proper range of moisture content helps to prevent compaction and clodding. Stones more than 10 inches in diameter are near the surface. They can hinder tillage.

Some areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the main hazard. Measures that control runoff and help to prevent excessive soil loss are needed. Examples are a cropping sequence that includes grasses and legumes, a system of conservation tillage that leaves all or part of the crop residue on the surface, diversions, contour farming, grassed waterways, and grade stabilization structures. More than one of these measures generally are needed. Cover crops help to maintain tilth and the organic matter content.

A cover of grasses and legumes, such as bromegrass and alfalfa, for hay and pasture is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The slope and the wetness are moderate limitations if this soil is used as a site for dwellings. The dwellings should be designed so that they conform to the natural slope of the land. Land shaping and installing retaining walls also help to overcome the slope. Foundation drains reduce the wetness. The slope and frost action are moderate limitations on sites for local roads and streets. Constructing the roads on contour and land shaping help to overcome the slope.

The restricted permeability and the wetness are limitations if this soil is used as a site for septic tank absorption fields. Filling or mounding with better suited material help to minimize these limitations. If the disposal system is poorly designed, seepage on top of the till can move laterally several feet before surfacing.

The land capability classification is IVe. The woodland ordination symbol is 4a.

**LxD3—Losantville clay loam, stony subsoil, 12 to 18 percent slopes, severely eroded.** This strongly sloping, deep, well drained soil is on irregularly shaped knolls and narrow, elongated breaks along drainageways and depressions on moraines. Individual areas range from 3 to 80 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is yellowish brown clay loam about 2 inches thick. The subsoil is yellowish brown, firm clay loam about 12 inches thick. It has a stone about 11 inches in diameter. The substratum to a depth of about 60 inches is yellowish brown loam glacial till. In some areas the slope is less than 12 or more than

18 percent. In a few places the subsoil has no large stones. In some of the less eroded areas, the surface layer is silt loam or loam and is surface soil material mixed with material from the upper part of the subsoil. In some places the substratum is sand and gravel within a depth of 60 inches. In other places the depth to the substratum is less than 10 or more than 22 inches.

Included with this soil in mapping are many areas of the somewhat poorly drained Crosby soils in drainageways. Also included are a few small areas of soils that are not eroded. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Losantville soil. Permeability is moderate or moderately slow in the subsoil and slow in the substratum. Surface runoff is very rapid in cultivated areas. The seasonal high water table is commonly at a depth of 4 to 6 feet in winter and early in spring. Organic matter content is low in the surface layer. It has been reduced by erosion. The surface layer is firm. Tilling within the proper range of moisture content helps to prevent compaction and clodding. Stones more than 10 inches in diameter are near the surface. They can hinder tillage.

Some areas are wooded. Some are used for grasses and legumes for forage or pasture. Very little of the acreage is used for cultivated crops. This soil is generally unsuitable for corn, soybeans, and small grain, mainly because of the hazard of further erosion. Operating most types of farm machinery is difficult because of the slope.

This soil is fairly well suited to grasses and legumes, such as bromegrass and alfalfa, for forage and pasture. Some areas have a permanent grass cover because of the difficulty in establishing seedlings. In some areas gullies have formed. Farm machinery cannot easily cross these areas. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concerns are the erosion hazard, the equipment limitation, seedling mortality, and plant competition. Because of the erosion hazard and the equipment limitation, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The slope is a severe limitation if this soil is used as a site for dwellings. The dwellings should be designed so that they conform to the natural slope of the land. Land shaping and installing retaining walls also help to overcome the slope. Because of the erosion hazard, the existing vegetation should be disturbed as little as possible during construction and those areas that are disturbed should be revegetated as soon as possible. The slope is a severe limitation on sites for local roads and streets. It can be overcome by cutting and filling and by building on the contour.

The restricted permeability and the slope are severe limitations if this soil is used as a site for septic tank absorption fields. Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly. Filling or mounding with better suited material helps to minimize the restricted permeability.

The land capability classification is VIe. The woodland ordination symbol is 4r.

**Ma—Martisco muck, drained.** This nearly level, deep, very poorly drained soil is on the lower outwash plains along the major glacial meltwater channels. It is subject to ponding. Individual areas are long and narrow and range from 5 to 200 acres in size.

In a typical profile, the surface layer is black muck about 8 inches thick. The subsurface layer also is black muck. It is about 7 inches thick. The upper part of the substratum is light brownish gray, massive marl. The next part is gray, massive gravelly loam. The lower part to a depth of about 60 inches is gray very gravelly sandy loam that has thin strata of silty material. In some areas the substratum is silty to a depth of 60 inches. In some places the organic material is more than 16 inches thick. In other places the substratum is sand and gravelly coarse sand.

Included with this soil in mapping are small areas of the poorly drained Cyclone and very poorly drained Millgrove and Westland soils in the slightly higher landscape positions. These are mineral soils. Also included are small undrained areas that are too wet for cultivation. Included soils make up 5 to 12 percent of the map unit.

Available water capacity is high in the Martisco soil. Permeability is moderate or moderately rapid in the organic material, slow in the marl, and moderately rapid in the lower part of the soil. Surface runoff is very slow or ponded. Organic matter content is very high in the surface layer. The seasonal high water table is near or above the surface.

Most areas of this soil are used for cultivated crops. A few are used for pasture.

Even though it is drained, this soil is poorly suited to corn, soybeans, and specialty crops, such as onions and potatoes. The wetness is a severe limitation. If tile drains are installed, special covering material may be needed to keep sand out of the tile. Soil blowing is a hazard when the soil is dry and has no vegetative cover. Overdrainage causes excessive subsidence. Fire is a hazard because muck can burn when dry. Diverting the surface runoff from the adjacent uplands reduces the wetness of this soil. Cover crops and crop residue management help to

control soil blowing during winter and spring. Shrub windbreaks help to control soil blowing throughout the year.

This soil is fairly well suited to grasses, such as reed canarygrass and redtop, for hay and pasture. It is poorly suited to deep rooted legumes, such as alfalfa, however, because of the wetness. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to trees. The main management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Equipment should be used only when the soil is frozen. Planting special nursery stock and overstocking reduce the seedling mortality rate. Windthrown trees should be periodically removed. Unwanted trees and shrubs can be controlled by adequate site preparation or by spraying, cutting, or girdling.

Because the slow permeability and the ponding are severe limitations, this soil is generally unsuited to dwellings and sanitary facilities. Ponding, frost action, and low strength are severe limitations on sites for local roads. Replacing the organic layers with suitable material helps to overcome low strength. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and frost action.

The land capability classification is IVw. The woodland ordination symbol is 2w.

**MIA—Miami silt loam, gravelly substratum, 0 to 2 percent slopes.** This nearly level, deep, well drained soil is on broad flats on till plains. Individual areas range from 20 to 1,200 acres in size.

In a typical profile, the surface layer is brown silt loam about 7 inches thick. The subsurface layer also is brown silt loam. It is about 4 inches thick. The subsoil is about 29 inches of dark yellowish brown, firm clay loam and loam. The substratum to a depth of about 60 inches is yellowish brown loam that contains free carbonates. Stratified sand and gravelly sand underlie the loam glacial till below a depth of 60 inches. In some areas the substratum is loose sand and gravel. In other areas the depth to loam glacial till is more than 40 inches. In some places the slope is more than 2 percent. In other places the subsoil is clayey.

Included with this soil in mapping are small areas of the somewhat poorly drained Crosby soils in the slightly lower landscape positions and small areas of the poorly drained Cyclone and very poorly drained Treaty soils in depressions and narrow drainageways. Also included are small areas of soils that are eroded. Included soils make up 2 to 8 percent of the map unit.

Available water capacity is high in the Miami soil. Permeability is moderate. Surface runoff is slow. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodlots.

This soil is well suited to corn, soybeans, and small grain. A system of conservation tillage that leaves all or part of the crop residue on the surface, crop rotations, cover crops, and green manure crops help to maintain tilth and the organic matter content and conserve moisture.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

A few areas are wooded. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling, by special harvest methods, and by adequate site preparation.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Strengthening foundations and footings and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. Low strength is a severe limitation on sites for local roads and streets. The base material should be strengthened or replaced with a better suited material.

If this soil is used as a site for septic tank absorption fields, the restricted permeability is a limitation. It can be minimized by filling or mounding with better suited material.

The land capability classification is I. The woodland ordination symbol is 5a.

**MIB2—Miami silt loam, gravelly substratum, 2 to 6 percent slopes, eroded.** This gently sloping, deep, well drained soil is on slight rises on till plains. Individual areas are irregular in shape and range from 5 to 240 acres in size.

In a typical profile, the surface layer is mixed dark grayish brown and brown silt loam about 10 inches thick. The subsurface layer is brown silt loam about 5 inches thick. The subsoil is about 24 inches of dark yellowish brown and brown, firm silty clay loam and clay loam. The substratum to a depth of about 60 inches is yellowish brown loam that contains free carbonates. Stratified sand and gravelly coarse sand underlie the loam glacial till below a depth of 60 inches. In some places the slope is less than 2 or more than 6 percent. In other places the depth to loam glacial till is more than 40 inches. In some areas the substratum is loose sand and gravel. In other areas the depth to the substratum is less than 20 inches. In places the subsoil is clayey.

Included with this soil in mapping are small areas of the somewhat poorly drained Crosby soils in the lower landscape positions, the poorly drained Cyclone and Treaty soils in narrow drainageways, severely eroded soils in which the clay loam subsoil is exposed, and soils that have gravel and cobbles on the surface. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Miami soil. Permeability is moderate. Surface runoff is medium. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodlots.

This soil is well suited to corn, soybeans, and small grain. Erosion is the main hazard. A cropping sequence that includes grasses and legumes, a system of conservation tillage that leaves all or part of the crop residue on the surface, diversions, contour farming, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops also help to control erosion and improve or maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture. A cover of grasses and legumes is effective controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

A few areas are wooded. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling, by special harvest methods, and by adequate site preparation.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Strengthening foundations and footings and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. Low strength is a severe limitation on sites for local roads and streets. The base material should be strengthened or replaced with better suited material.

If this soil is used as a site for septic tank absorption fields, the restricted permeability is a limitation. It can be minimized by filling or mounding with better suited material.

The land capability classification is IIe. The woodland ordination symbol is 5a.

**MmB2—Miamian silt loam, 2 to 6 percent slopes, eroded.** This gently sloping, deep, well drained soil is on broad till plains and along drainageways and streams. Individual areas are irregular in shape and range from 3 to 80 acres in size.

In a typical profile, the surface layer is dark brown and dark yellowish brown silt loam about 9 inches thick. The subsoil is about 23 inches of dark yellowish brown and yellowish brown, firm clay loam and clay. The substratum to a depth of about 60 inches is yellowish brown loam that contains free carbonates. In some areas the slope is more than 6 percent. In some small areas the subsoil is stratified with sandy loam, loamy sand, and sandy clay loam. In some places the substratum is sand and gravelly coarse sand at a depth of about 60 inches. In other places the subsoil contains less clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Crosby soils in the lower landscape positions and the poorly drained Cyclone soils in narrow drainageways. Cyclone soils are darker than the Miamian soil. Also included are small areas of severely eroded soils in which the clay loam subsoil is exposed and small areas of soils that have gravel and cobbles on the surface. Included soils make up 5 to 14 percent of the map unit.

Available water capacity is moderate in the Miamian soil. Permeability is moderately slow. Surface runoff is medium. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodlots.

This soil is well suited to corn, soybeans, and small grain. Erosion is the main hazard. A cropping sequence that includes grasses and legumes, a system of conservation tillage that leaves all or part of the crop residue on the surface, diversions, contour farming, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops also help to control erosion and improve or maintain tilth and the organic matter content. Subsurface drains are needed in seepy areas in some drainageways and swales.

This soil is well suited to grasses or legumes, such as bromegrass and alfalfa, for hay or pasture. A cover of grasses and legumes is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

A few areas are wooded. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Limitations are slight if this soil is used as a site for dwellings with basements. The shrink-swell potential is a moderate limitation on sites for dwellings without basements. Strengthening foundations and footings and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. Frost action is a moderate limitation on sites for local

roads and streets. The base material should be strengthened or replaced with better suited material.

If this soil is used as a site for septic tank absorption fields, the restricted permeability is a severe limitation. It can be minimized by filling or mounding with better suited material. If the disposal system is poorly designed, seepage on the top of the till can move laterally several feet before surfacing.

The land capability classification is IIe. The woodland ordination symbol is 5a.

**MoB2—Miamian silt loam, stony subsoil, 2 to 6 percent slopes, eroded.** This gently sloping, deep, well drained soil is on rises on till plains and along drainageways and streams. Individual areas are irregular in shape and range from 5 to 100 acres in size.

In a typical profile, the surface layer is brown silt loam about 7 inches thick. It is mixed with small chunks of yellowish brown silty clay loam. The subsoil is about 27 inches thick. It has a stone about 15 inches in diameter. It is yellowish brown and firm. The upper part is silty clay loam, and the lower part is clay loam. The substratum to a depth of about 60 inches is yellowish brown loam that contains free carbonates. In some areas the slope is less than 2 or more than 6 percent. In a few places the subsoil has no large stones. In places the depth to the substratum is less than 20 inches. In some areas the soil is underlain by sand and gravel at a depth of about 60 inches. In other areas the subsoil contains less clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Crosby soils in the lower landscape positions and the poorly drained Treaty soils in depressions. These soils have a stony subsoil. Also included are small areas of severely eroded soils in which the clay loam subsoil is exposed. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Miamian soil. Permeability is moderately slow. Surface runoff is medium in cultivated areas. Organic matter is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content. Stones more than 10 inches in diameter are near the surface. They can hinder tillage.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodland.

This soil is well suited to corn, soybeans, and small grain. A cropping sequence that includes grasses and legumes, a system of conservation tillage that leaves all or part of the crop residue on the surface, diversions, contour farming, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops also help to control erosion and improve or maintain tilth and the organic matter content. Subsurface drains are needed in seepy areas in some drainageways and swales.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture. A cover of grasses and legumes is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

A few areas are wooded. This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, and girdling.

Limitations are slight if this soil is used as a site for dwellings with basements. The shrink-swell potential is a moderate limitation on sites for dwellings without basements. Strengthening foundations and footings and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. Frost action is a moderate limitation on sites for local roads and streets. The base material should be strengthened or replaced with better suited material.

If this soil is used as a site for septic tank absorption fields, the restricted permeability is a severe limitation. It can be minimized by filling or mounding with better suited material. If the disposal system is poorly designed, seepage on top of the till can move laterally several feet before surfacing.

The land capability classification is IIe. The woodland ordination symbol is 5a.

**Mx—Millgrove loam.** This nearly level, deep, very poorly drained soil is on terraces and on narrow outwash plains along minor glacial streams. Individual areas are irregularly shaped or elongated and range from 20 to 160 acres in size. The dominant size is about 80 acres.

In a typical profile, the surface layer is very dark gray loam about 7 inches thick. The subsurface layer is very dark gray clay loam about 5 inches thick. The subsoil is about 24 inches thick. The upper part is grayish brown and dark gray, mottled, firm clay loam, and the lower part is dark gray, mottled, friable and firm loam. The substratum to a depth of about 60 inches is grayish brown, mottled gravelly loam. In some places the soil is underlain by sand and gravelly coarse sand. In other places the dark surface soil is only 7 to 9 inches thick. In some areas the soil is underlain by loam till. In a few areas it has several inches of lighter colored overwash. In places the surface layer is mucky.

Included with this soil in mapping are small areas of the somewhat poorly drained Crosby and Sleeth soils in the slightly higher positions on the landscape. These soils make up 2 to 5 percent of the map unit.

Available water capacity is high in the Millgrove soil. Permeability is moderate. Surface runoff is slow to ponded. The seasonal high water table is frequently near or above the surface from fall through early spring. Organic matter content is high in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are drained and are used for cultivated crops. Some are used for pasture, hay, or woodlots.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it is well suited to intensive row cropping. Excess water can be removed by subsurface drains, surface drains, pumps, or a combination of these. Winter cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface improve or maintain tilth and the organic matter content.

This soil is well suited to grasses, such as reed canarygrass and redtop, and legumes, such as white clover, for hay or pasture. A drainage system is needed. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

This soil is fairly well suited to trees. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. Because the wetness restricts the use of equipment, the trees are usually harvested only during dry periods or when the ground is frozen. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because the ponding is a severe hazard, this soil is generally unsuited to dwellings and sanitary facilities. Ponding and frost action are severe hazards on sites for local roads. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and frost action.

The land capability classification is IIw. The woodland ordination symbol is 5w.

**Ot—Orthents and Aquents, loamy.** These nearly level to moderately sloping, well drained to poorly drained soils are in cut and filled areas around highway interchanges, shopping centers, factories, and schools and in rural areas. In places, deep cuts have been made into the original soil and only the deep substratum remains. Other areas consist mostly of fill material. Some borrow areas have filled with water and are used for various types of recreation and wildlife habitat. Individual areas are generally irregular in shape and range from 3 to 40 acres in size.

This map unit is about 80 percent Orthents and 20 percent Aquents. These soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

In a typical profile, these soils are a mixture of displaced surface soil, subsoil, and substratum material. They are mainly silt loam, loam, clay loam, and silty clay loam. In some areas they contain some gravel, sand, or stones. In a typical area where a deep cut has been made, the soil material is mainly loam glacial till or gravelly coarse sand. Some areas have discarded bricks, stones, wood, and metal. Some are spoil areas around gravel pits.

Included with these soils in mapping are small areas of the poorly drained Cyclone, somewhat poorly drained Crosby, well drained Miamian and Eldean, and very poorly drained Westland and Millgrove soils. These included soils are along the edges of the mapped areas. They make up about 10 percent of the map unit.

The properties of the Orthents and Aquents vary. Generally, available water capacity is moderate and permeability is moderate to slow. In most areas some type of topsoil has been spread over the surface in order to establish vegetation. As a result, organic matter content generally is low or moderate.

Most areas of these soils have a permanent cover of grass or low shrubs. Many are surrounded by heavily traveled highways. Very few are used for crops or woodland.

Special management is needed if these soils are used for crops. This management includes an intensive fertilization program with special emphasis on using organic residue or manure. Measures that control erosion are needed in the gently sloping and moderately sloping areas. Examples are diversions, box inlet structures, grade stabilization structures, and grassed waterways. Exposed areas should be revegetated as soon as possible after construction. A drainage system is needed in some of the nearly level areas. If trees and shrubs are planted, seedling mortality may be a problem.

Because the soil material varies, onsite investigation is needed if these soils are to be used as building sites. Removing as little vegetation as possible during construction and establishing a protective plant cover as soon as possible after construction help to control erosion. A drainage system is needed in some of the nearly level areas.

No land capability classification or woodland ordination symbol is assigned.

**Pt—Pits, gravel.** This map unit consists of open excavations where soil material has been removed and the underlying sand and gravel exposed. The excavations vary in depth. In some areas the pits are still mined for sand and gravel, but in many areas they have been abandoned. They are typically in outwash areas of Eldean and Sleeth soils; Miami soils, which have a gravelly substratum; and Westland soils. In some areas they are excavations into hillsides. In some of the pits, nearly all the sand and gravel have been removed and the remaining soil material is too fine textured to be used

as a source of gravel. Individual areas are generally square or rectangular and range from 3 to 80 acres in size.

Included with this unit in mapping are areas where soil material and sand and gravel have been dumped adjacent to the pits. The soil beneath the dumped material is commonly similar to the adjacent soils. Also included are a few small areas of water. Included areas make up about 5 percent of the map unit.

These pits are not suited to farm or urban uses. They are generally suited only to wildlife habitat and some recreation uses.

No land capability classification or woodland ordination symbol is assigned.

**Sg—Shoals loam, occasionally flooded.** This nearly level, deep, somewhat poorly drained soil is on flood plains. Individual areas are irregularly shaped on the broad flood plains and long and narrow in the valleys along the smaller streams. They range from 3 to 100 acres in size.

In a typical profile, the surface layer is dark grayish brown loam about 8 inches thick. The upper part of the substratum is dark grayish brown, dark brown, and grayish brown, mottled, friable loam. The lower part to a depth of about 60 inches is gray, mottled, massive, stratified loam, sandy loam, silt loam, and loamy sand. In places the upper part of the soil is loamy sand.

Included with this soil in mapping are small areas of the well drained Genesee soils on the slightly higher parts of the landscape and the very poorly drained Sloan soils on the slightly lower parts. Included soils make up 5 to 14 percent of the map unit.

Available water capacity is high in the Shoals soil. Permeability is moderate. Surface runoff is slow. The seasonal high water table is at a depth of 0.5 foot to 1.5 feet late in winter and early in spring. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are wooded. Very few are pastured.

This soil is well suited to corn, soybeans, and small grain. The major limitation is the wetness, and the major hazard is the seasonal flooding. A drainage system improves crop growth and the timeliness of tillage. Subsurface drains, surface drains, or both can be used. If the soil is adequately drained, row crops can be grown in most years. Even in drained areas, however, small grain crops can be damaged by floodwater late in winter and early in spring. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to maintain the organic matter content and good tilth.

Some drained areas are used for hay or pasture. This soil is poorly suited to deep rooted legumes, such as alfalfa, because the high water table in the spring restricts the growth of roots and because flooding is a hazard. The soil is well suited to reed canarygrass and redtop for pasture or hay. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Restricted grazing during wet periods, proper stocking rates, and pasture rotation help to keep the pasture in good condition.

This soil is fairly well suited to trees. Plant competition is the main management concern. Also, the seasonal flooding and the overflow channels can hinder tree planting or harvesting. Planting and harvesting equipment should be used only during dry periods. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because the flooding and the wetness are severe limitations, this soil is generally unsuited to dwellings and sanitary facilities. Frost action, flooding, and wetness are severe limitations on sites for local roads. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by these limitations.

The land capability classification is IIw. The woodland ordination symbol is 5w.

**Sk—Sleeth silt loam.** This nearly level, deep, somewhat poorly drained soil is on broad terraces. Individual areas generally are irregular in shape. They range from 3 to 50 acres in size.

In a typical profile, the surface layer is dark grayish brown silt loam about 10 inches thick. The subsurface layer is grayish brown, mottled loam about 3 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown, mottled, firm clay loam; the next part is grayish brown, mottled, firm clay loam; and the lower part is grayish brown, mottled, friable loam. The substratum to a depth of about 60 inches is grayish brown, loose, stratified sand and gravelly coarse sand. In places the depth to sand and gravel is less than 40 inches. In some areas the soil is underlain by stratified fine sand and silty material. In other areas the substratum is loam till.

Included with this soil in mapping are small areas of the well drained Eldean soils in the slightly higher landscape positions and areas of the very poorly drained Westland soils in the lower positions. Included soils make up 5 to 12 percent of the map unit.

Available water capacity is moderate in the Sleeth soil. Permeability is moderate in the subsoil and very rapid in the substratum. Surface runoff is slow in cultivated areas. The seasonal high water table is at a depth of 1 to 3 feet. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for hay or pasture. A few support hardwoods.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. Excess water can be removed by surface or subsurface drains. Winter cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface improve or maintain the organic matter content, fertility, and tilth.

If adequately drained, this soil is well suited to grasses and legumes, such as bromegrass, redtop, and white clover, for hay and pasture. It is not well suited to alfalfa and other deep rooted legumes, however, because of wetness and frost heaving. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling.

The wetness is a severe limitation if this soil is used as a site for dwellings. Constructing the dwellings on raised, well compacted fill material reduces the wetness. Also, installing subsurface drains helps to lower the water table. Low strength and frost action are severe limitations on sites for local roads and streets. Strengthening or replacing the base material with better suited material helps to overcome these limitations.

If this soil is used as a site for septic tank absorption fields, the wetness is a severe limitation. It can be minimized by filling or mounding with suitable material and by installing drains around the outer edges of the absorption field.

The land capability classification is IIw. The woodland ordination symbol is 5a.

**Sn—Sloan silty clay loam, occasionally flooded.** This nearly level, deep, very poorly drained soil is on flood plains. Individual areas are irregularly shaped on the broad flood plains and long and narrow in the valleys along the smaller streams. They range from 10 to 80 acres in size.

In a typical profile, the surface layer is very dark gray silty clay loam about 7 inches thick. The subsurface layer is very dark grayish brown, mottled silty clay loam about 6 inches thick. The subsoil is about 27 inches of dark gray and gray, mottled silty clay loam and stratified loam, clay loam, and sandy clay loam. The substratum to a depth of about 60 inches is dark gray, mottled, friable, stratified gravelly loam, silt loam, silty clay loam, and sandy loam. In some places the surface layer is mucky. In other places the substratum is sand or gravelly coarse sand below a depth of 40 inches. In some small areas the soil has 10 to 20 inches of lighter colored overwash.

Included with this soil in mapping are small areas of the well drained Genesee and somewhat poorly drained Shoals soils on the slightly higher parts of the landscape. These soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Sloan soil. Permeability is moderate or moderately slow. Surface runoff is very slow or ponded in cultivated areas. The seasonal high water table is at or near the surface in winter and spring. Organic matter content is high in the surface layer. This layer becomes cloddy and hard to work if tilled when too wet.

Most areas of this soil are used for cultivated crops. A few are wooded. Very few are pastured.

This soil is fairly well suited to corn and soybeans. The major limitation is the wetness, and the major hazard is the seasonal flooding. A drainage system improves crop growth and the timeliness of tillage. Subsurface drains, surface drains, or both can be used. If the soil is adequately drained, row crops can be grown in most years. Even in drained areas, however, floodwater can damage small grain crops that are planted in fall or early in spring. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to maintain the organic matter and good tilth.

Some drained areas are used for hay and pasture. This soil is well suited to reed canarygrass, redtop, and white clover. It is poorly suited to deep rooted legumes, such as alfalfa, because the high water table restricts the growth of roots and because flooding is a hazard. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Restricted grazing during wet periods, proper stocking rates, and pasture rotation help to keep the pasture in good condition.

This soil is fairly well suited to trees. The seasonal flooding and the overflow channels can hinder tree planting or harvesting. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. Because the wetness restricts the use of equipment, the trees are usually harvested only during extremely dry periods or when the ground is frozen. Windthrown trees should be periodically removed. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because the flooding and the wetness are severe limitations, this soil is generally unsuited to dwellings and sanitary facilities. Low strength, wetness, and flooding are severe limitations on sites for local roads (fig. 6). Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by these limitations.

The land capability classification is IIIw. The woodland ordination symbol is 5w.

**Ts—Treaty silt loam, stony subsoil.** This nearly level, deep, poorly drained soil is in depressions, swales, and narrow drainageways on glacial till plains and moraines. It is subject to ponding. Individual areas are irregular in shape and range from 3 to 80 acres in size. The dominant size is about 20 acres.

Figure 6.—Flooding on a local road in an area of Sloan silty clay loam, occasionally flooded.

In a typical profile, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is very dark gray silty clay loam about 4 inches thick. The subsoil is about 39 inches thick. It has a stone about 14 inches in diameter. The upper part is dark gray, mottled, firm silty clay loam, and the lower part is gray and yellowish brown, mottled, firm and friable clay loam and loam. The substratum to a depth of about 60 inches is brown, mottled loam. In a few places the silty mantle is as much as 25 inches thick. In some areas the soil is underlain by gravelly loam, gravelly sandy loam, or gravelly coarse sand. In places the depth to the substratum is less than 40 inches. In some areas the subsoil is clayey. In other areas it has no large stones.

Included with this soil in mapping are many small areas of the somewhat poorly drained Crosby soils on slight rises and a few areas of the well drained Miamian soils along small drainageways or on small mounds. Miamian soils dry out more quickly in the spring than the Treaty soil. Included soils make up about 8 percent of the map unit.

Available water capacity is high in the Treaty soil. Permeability is moderate in the subsoil and moderately slow in the substratum. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface in winter and early in spring. Organic matter content is high in the surface layer. This layer can become cloddy if tilled when too wet. Some stones more than 10 inches in diameter are near the surface. They can hinder tillage.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. Winter wheat, however, is often destroyed by ponded water. Surface and subsurface drains are needed to remove excess water. In places the stones more than 10 inches in diameter hinder the installation of subsurface drains. In adequately drained areas, a conservation cropping system dominated by row crops can be used. Cover crops and a system of conservation tillage that leaves all or part of

the crop residue on the surface help to maintain or improve the organic matter content and good tilth.

This soil is well suited to grasses and legumes, such as reed canarygrass and birdsfoot trefoil, for hay or pasture. It is better suited to grasses than to deep rooted legumes because of the wetness. A drainage system is needed. Grazing when the soil is wet can result in surface compaction and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is fairly well suited to trees. The few wooded areas are not drained. The main management concerns are the equipment limitations, plant competition, the windthrow hazard, and seedling mortality. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled or removed by site preparation or by cutting, spraying, or girdling. Replanting may be needed. Windthrown trees should be periodically removed.

Because the ponding is a severe hazard, this soil is generally unsuited to dwellings and sanitary facilities. Ponding, frost action, and low strength are severe limitations on sites for local roads. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and frost action. Strengthening or replacing the base material with better suited material improves the ability of the roads to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 5w.

**Wb—Washtenaw silt loam.** This deep, poorly drained soil is in upland drainageways and in depressions that parallel streams. It is subject to ponding. Individual areas are elongated or round. They range from 3 to 20 acres in size.

In a typical profile, the surface layer is dark grayish brown silt loam about 8 inches thick. The next layer is dark gray silt loam about 12 inches thick. This layer is underlain by an older buried soil. The surface layer of the buried soil is very dark gray, mottled silty clay loam about 3 inches thick. The buried subsoil is about 27 inches thick. It is gray, olive gray, and grayish brown, mottled, firm clay loam and silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. In some areas the subsoil and substratum are more silty. In other areas lighter colored, more sandy outwash material has been deposited on the surface. In some places the soil is underlain by sand and gravelly coarse sand. In other places it is better drained.

Included with this soil in mapping are areas of the somewhat poorly drained Crosby soils on the slightly higher parts of the landscape. Also included are areas of the well drained Losantville and Miamian soils in the higher landscape positions. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Washtenaw soil. Permeability is moderate in the upper part of the soil and slow in the lower part. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface in winter and early in spring. Organic matter content is moderate in the surface layer. This layer becomes cloddy and hard to work if tilled when too wet.

Most areas of this soil are drained and are used for cultivated crops. A few are used for hay, pasture, or woodlots.

If adequately drained, this soil is well suited to corn and soybeans. Most areas have been drained by subsurface drains, surface drains, or both. Winter cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface improve or maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. A drainage system is needed. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, timely deferment of grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

This soil is fairly well suited to trees. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. Because the wetness restricts the use of equipment, trees are usually harvested only during extremely dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by adequate site preparation or by spraying, cutting, or girdling. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard.

Because the ponding is a severe hazard, this soil is generally unsuited to dwellings and sanitary facilities. Ponding and frost action are severe hazards on sites for local roads. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and frost action.

The land capability classification is IIw. The woodland ordination symbol is 5w.

**We—Westland silt loam.** This nearly level, deep, very poorly drained soil is in depressions and other areas on outwash plains, valley trains, and terraces. It is subject to ponding (fig. 7). Individual areas are irregular in shape and range from 3 to 300 acres in size. The dominant size is about 80 acres.

In a typical profile, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsoil is about 35 inches thick. It is mottled and firm.

**Figure 7.—Ponding in a depressional area of Westland silt loam.**

The upper part is dark grayish brown clay loam, and the lower part is grayish brown gravelly sandy clay loam. The substratum to a depth of about 60 inches is grayish brown, loose gravelly coarse sand. In some places the depth to gravelly coarse sand is less than 40 inches. In other places the surface layer is lighter colored. In some small areas the substratum is stratified sandy, silty, or loamy material. In other small areas 3 or 4 feet of alluvium overlies the gravelly coarse sand. In some small areas the surface layer is mucky.

Included with this soil in mapping are rolling areas of the well drained Eldean soils and small, slightly convex areas of the somewhat poorly drained Sleeth soils. Both of these included soils are on the higher parts of the landscape. Also included are small pockets of lower lying soils that stay wet for longer periods than the Westland soil. Included soils make up 2 to 5 percent of the map unit.

Available water capacity is moderate in the Westland soil. Permeability is moderate in the subsoil and very rapid in the substratum. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface in fall and early in spring. Organic matter content is high in the surface layer. This layer is friable and can be easily worked throughout a wide range in moisture content.

Most areas of this soil are drained and are used for cultivated crops. Some are used for pasture, hay, or woodlots.

If adequately drained, this soil is well suited to corn, soybeans, and small grain (fig. 8). If drained and otherwise well managed, it is suited to intensive row cropping. Ponding is a hazard, especially if small grain crops are grown. The wetness is the main limitation. Excess water can be removed by subsurface drains,

surface drains, pumps, or a combination of these. Winter cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface improve or maintain tilth and the organic matter content.

This soil is well suited to grasses and shallow rooted legumes for hay or pasture. A drainage system is needed. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

This soil is fairly well suited to trees. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. Harvesting and logging equipment should be used only during dry periods or when the ground is frozen. Windthrown trees should be periodically removed. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because the ponding is a severe hazard, this soil is generally unsuited to dwellings and sanitary facilities. Ponding, frost action, and low strength are severe limitations on sites for local roads. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and frost action. Strengthening or replacing the base material with better suited material improves the ability of the roads to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 5w.

## Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture.

**Figure 8.—Soybeans in an area of Westland silt loam.**

It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 222,650 acres in Henry County, or 88 percent of the total acreage, meets the soil requirements for prime farmland. This land is in scattered areas throughout the county, mainly in general soil map units 1, 3, and 4, which are described under the heading "General Soil Map Units." Approximately 200,000 acres of the prime farmland is used for crops, mainly corn and soybeans. The crops grown on this land account for an estimated three-fourths of the county's total agricultural income each year (*3*).

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table qualify for prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not the limitation has been overcome by corrective measures.

# Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

## Crops and Pasture

Curtis H. Heaton, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Approximately 194,976 acres in the county was used for crops and pasture in 1978 (*4*). Of this total, 140,505 acres was used for row crops; 19,036 acres for permanent pasture; 17,435 acres for close grown crops, mainly wheat and oats; 14,000 acres for a crop rotation including hay or pasture; and 4,000 acres for other agricultural purposes.

The potential of the soils in Henry County for increased production of food is good. Production is likely to increase as farms become larger. It also can be increased by extending the latest crop production technology to more cropland. This soil survey can greatly facilitate the application of such technology.

The paragraphs that follow describe the major management concerns in the areas of the county used for crops and pasture. These concerns include drainage, water erosion, soil blowing, fertility, and tilth.

*Soil drainage* is the major management concern on about 60 percent of the cropland and pasture in the county. Most of the poorly drained and very poorly drained soils, such as Westland, Cyclone, Millgrove, Treaty, and Sloan soils, have been drained. A few areas of these soils, however, cannot be economically drained. They are depressional areas where deep drainage ditches to a suitable outlet would have to extend for great distances. These ditches are needed in many areas of Martisco soils. Only a few of these areas are adequately drained.

Unless drained, somewhat poorly drained soils are so wet that crops are damaged during most years. Examples are Crosby, Sleeth, and Shoals soils, which make up about 58,700 acres in the county.

The well drained Miamian and Losantville soils tend to dry out slowly after rains. Small areas of wetter soils along drainageways and in swales are commonly included in areas of these soils, especially those that have a slope of 2 to 6 percent. A drainage system is needed in some of these wetter areas.

The design of both surface and subsurface drainage systems varies with the kind of soil. A combination of surface drains and tile drainage is needed in most areas of the poorly drained and very poorly drained soils used for intensive row cropping. Drains should be more closely spaced in slowly permeable soils than in more permeable soils. Subsurface drainage is slow in Cyclone soils. Finding adequate outlets for tile drainage is difficult in many areas of Cyclone, Millgrove, Martisco, Westland, and Sloan soils.

Organic soils oxidize and subside when their pore space is filled with air. Therefore, special drainage systems are needed. Keeping the water table at the level required by the crops during the growing season and raising it to the surface during other parts of the year minimize the oxidation and subsidence of organic soils.

Information about the design of drainage systems for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

*Water erosion* is the major management concern on about 30 percent of the cropland and pasture in the county. It is a hazard if the slope is more than 2 percent.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as Celina, Crosby, Miamian, and Losantville soils. Erosion also reduces the productivity of soils that tend to be droughty, such as Eldean soils. Second, soil erosion results in sedimentation in streams. Control of erosion minimizes the pollution of streams by sediment and improves water quality for municipal use, for recreation, and for fish and other wildlife.

On clayey spots in many sloping fields, preparing a good seedbed and tilling are difficult because the original friable surface soil has been eroded away. Such spots are common in areas of the eroded Celina, Miamian, Eldean, and Losantville soils.

Erosion--control practices provide a protective cover, reduce the runoff rate, and increase the rate of water infiltration. A cropping system that keeps a vegetative cover on the soil for extended periods can hold soil losses to an amount that does not reduce the productive capacity of the soils. On livestock farms, where pasture and hay are needed, including forage crops of grasses and legumes in the cropping sequence reduces the susceptibility of the more sloping areas to erosion and provides nitrogen and improves tilth for the following crop.

Slopes are so short and irregular that contour tillage and terraces are used only on a limited basis on the more sloping soils in the county. On these soils cropping systems that provide a substantial vegetative cover are needed to control erosion unless conservation tillage is used. Minimizing tillage and leaving crop residue on the surface increase the rate of water infiltration and reduce the hazard of erosion. They are suitable practices on most of the soils in the county but are less successful on the eroded soils and on the soils that have a high percentage of clay in the surface layer, such as Cyclone soils. No-tillage for corn, which is common on an increasing acreage, is effective in controlling erosion on most of the soils in the county. It is less successful, however, on the soils that have a clayey surface layer.

Diversions and parallel tile-outlet terraces shorten the length of slopes and thus are effective in reducing the susceptibility to sheet, rill, and gully erosion. They are most practical on deep, well drained soils that are highly susceptible to erosion. Terraces reduce soil loss and the associated loss of fertilizer elements, help to prevent the damage to crops and water courses caused by eroding sediments, and help to eliminate the need for grassed waterways, which take productive land out of row crop production. They also make farming on the contour easier and thus reduce the consumption of fuel and the amount of pesticides entering watercourses.

Grassed waterways are needed in many areas of the more sloping soils, such as Celina, Miamian, Losantville, and Eldean soils. They also are needed in many areas where a large watershed drains across Crosby, Cyclone, and Treaty soils. A subsurface drainage system is generally needed below the waterways in areas of Crosby, Cyclone, and Treaty soils and in the many seepy areas of Celina, Miamian, and Losantville areas along drainageways.

Because of a large number of open ditches in the county, many grade stabilization structures are needed. These structures reduce the susceptibility to erosion in areas where surface water drains into an open ditch. Also, they are commonly needed in open ditches where the grade is excessive and the water moves so rapidly that erosion is a hazard on the sides and bottom of some channels.

*Soil blowing* is a hazard in drained areas of Martisco soils. It can damage these mucky soils in a few hours if winds are strong and the soils are dry and have no vegetation or surface mulch. Maintaining a cover of vegetation or mulch, keeping the surface rough through proper tillage methods, and growing windbreaks of adapted shrubs help to control soil blowing on these mucky soils. Soil blowing also is a hazard on dark mineral soils that do not have a protective plant cover. Soils that are plowed in the fall are very susceptible to soil blowing the following spring.

*Soil fertility* is naturally low or medium in most of the soils on uplands and terraces in the county. These soils tend to be strongly acid or medium acid unless they are limed. Applications of ground limestone generally are needed to raise the pH level sufficiently for good production of alfalfa and other crops that grow well only on nearly neutral soils. Available phosphorus and potash levels are naturally low in most of these soils.

The soils on flood plains, such as Genesee and Shoals soils, are neutral or mildly alkaline and are naturally higher in content of plant nutrients than most soils on uplands and terraces. The very poorly drained and poorly drained soils, such as Cyclone, Westland, Sloan, Treaty, Millgrove, and Martisco soils, are in slight depressions and receive runoff from the adjacent upland soils. They normally are slightly acid or neutral.

On all soils additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime needed.

*Soil tilth* is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils with good tilth are granular and porous.

Many of the soils used for crops in the county have a silt loam surface layer that is dark and is moderate in content of organic matter. Generally, the structure of these soils is moderate to weak, and a crust forms on the surface during periods of intense rainfall. In some areas the crust is hard when dry and impervious to water. As a result, it reduces the rate of water infiltration and increases the runoff rate. Regular additions of crop residue, manure, and other organic material can improve soil structure and help to prevent crusting.

Tilth is a problem in the dark Cyclone, Westland, Millgrove, Sloan, and Treaty soils, which often stay wet until late in spring. If plowed when wet, these soils tend to be very cloddy when dry. As a result, preparing a good seedbed is difficult. Fall plowing generally results in good tilth in the spring.

Fall plowing generally is not suitable on the light colored soils that have a silt loam surface layer because it results in crusting during winter and spring. Many of the soils are nearly as dense and hard at planting time as they were before they were plowed in the fall. Also, about 20 percent of the cropland is in areas of the more sloping soils that are subject to erosion if they are plowed in the fall.

*Field crops* suited to the soils and climate in the county include many that are not now commonly grown. Corn and soybeans are the main row crops. Wheat and oats are the chief close growing crops. Rye could be grown, and grass seed could be produced from bromegrass, orchardgrass, fescue, redtop, and bluegrass.

*Specialty crops* are of limited commercial importance in the county. Only a small acreage is used for vegetables and small fruits. Deep, well drained soils that warm up early in spring are especially well suited to many vegetables and small fruits. Examples are the Eldean soils that have a slope of less than 6 percent. These soils make up about 17,300 acres in the county. If they were used for specialty crops, irrigation would be needed. Crops can generally be planted and harvested earlier on these soils than on the other soils in the county.

If adequately drained, mucks are well suited to a wide range of vegetable crops. Martisco muck is an example. It makes up about 1,600 acres in the county.

Most of the well drained soils are suitable for orchards and nursery plants. Most of the soils in low positions where frost is frequent and air drainage is poor, however, are poorly suited to early vegetables, small fruits, and orchards.

The latest information about growing specialty crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

## Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

## Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops,

the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

*Capability classes*, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

*Capability subclasses* are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

## Woodland Management and Productivity

Greg Yapp, Indiana Department of Natural Resources, helped prepare this section.

About 17,000 acres in Henry County, or less than 7 percent of the total acreage, is woodland. At one time, vast areas of forest were in the county. Most of these areas have been cleared. Many of the remaining tracts of timber are in areas that were considered too erosive, too wet, or too droughty for farming. The largest tracts are along the major streams and in the more rolling areas.

Changes in farming methods, equipment, and economics threaten to further reduce the acreage of woodland in the county. Most of the soils are suitable for some kind of timber production. Each soil differs from other soils in regard to the soil properties that affect tree growth. This soil survey can be helpful in selecting trees that are suited to a particular site and in identifying the soils that have the best potential for woodland.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *r* indicates steep slopes; *x*, stoniness or rockiness; *w*, excess water in or on the soil; *t*, toxic substances in the soil; *d*, restricted rooting depth; *c*, clay in the upper part of the soil; *s*, sandy texture; and *f*, a high content of rock fragments in the soil. The letter *a* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: r, x, w, t, d, c, s, and f.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

*Erosion hazard* is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention

measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

*Equipment limitation* reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

*Seedling mortality* refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

*Windthrow hazard* is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. It applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

*Trees to plant* are those that are suitable for commercial wood production.

## Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

## Recreation

Curt Heaton, district conservationist, Soil Conservation Service, helped prepare this section.

Recreation is a growing industry in Henry County. Because of recent developments of water resources and the close proximity to large metropolitan areas, the number of recreational enterprises in the county has increased. The county provides opportunities for fishing, canoeing, camping, hunting, golfing, and picnicking (fig. 9). Additional opportunities for outdoor recreation will be available as a watershed project in the county is completed.

**Figure 9.—A recreational pond in an area of Losantville clay loam, 12 to 18 percent slopes, severely eroded.**

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

*Camp areas* require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

*Picnic areas* are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

*Playgrounds* require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

*Paths and trails* for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

*Golf fairways* are subject to heavy foot traffic and some light vehicular traffic (fig. 10). Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

## Wildlife Habitat

John Russell, Indiana Department of Natural Resources, helped prepare this section.

Good wildlife habitat is in the upland areas and along the major flood plains in Henry County. A few wetland and marsh areas provide habitat for aquatic animals and waterfowl. Fence rows, woodland, and other types of cover also provide habitat for wildlife, including upland game. The Wilbur Wright Fish and Game Area and the upper reaches of the Summit Lake Area are managed primarily for wildlife. Deer, rabbits, quail, squirrels, muskrats, and many other species are common in the county.

Wildlife habitat can be improved in many areas in the county. Because of a wide range of soils, topography, and vegetative cover, the potential is good for various kinds of wildlife habitat. This soil survey can be very useful in identifying unique wildlife areas and areas where wildlife habitat can be improved.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

*Grain and seed crops* are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, soybeans, wheat, oats, sorghum, sunflowers, and barley.

*Grasses and legumes* are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available

**Figure 10.—A golf course on Losantville silt loam, 12 to 18 percent slopes, eroded, in the background, and on Crosby silt loam, 0 to 3 percent slopes, in the foreground.**

water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, lovegrass, bromegrass, bluegrass, clover, and alfalfa.

*Wild herbaceous plants* are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, ragweed, pokeweed, sheep sorrel, dock, crabgrass, and dandelion.

*Hardwood trees* and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, wild cherry, maple, beech, willow, black walnut, apple, hawthorn, dogwood, hickory, hazelnut, blackberry, and elderberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, crabapple, Washington hawthorn, and shrub dogwood.

*Coniferous plants* furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

*Wetland plants* are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, pondweed, spikerush, wild millet, wildrice, algae, cordgrass, waterplantain, arrowhead, rushes, sedges, and reeds.

*Shallow water areas* have an average depth of less than 5 feet. Some are naturally wet areas. Others are

created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

*Habitat for openland wildlife* consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, dove, pheasant, meadowlark, killdeer, field sparrow, cottontail, red fox, and woodchuck.

*Habitat for woodland wildlife* consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and white-tailed deer.

*Habitat for wetland wildlife* consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, rails, kingfishers, muskrat, mink, and beaver.

Edge habitat consists of areas where major land uses or cover types adjoin. A good example is the border between dense woodland and a field of no-till corn. Although not rated in the table, edge habitat is of primary importance to animals from the smallest songbirds to white-tailed deer. Most of the animals that inhabit openland or woodland habitat also frequent edge habitat, and desirable edge areas are consistently used by 10 times as many wildlife as are the centers of large areas of woodland or cropland.

## Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

*Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.*

*The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.*

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

### Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the

limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

*Shallow excavations* are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table (fig. 11) and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

*Dwellings and small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

*Local roads and streets* have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

*Lawns and landscaping* require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

**Sanitary Facilities**

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

*Septic tank absorption fields* are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

*Sewage lagoons* are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly

**Figure 11.—The seasonal high water table near the surface in an area of Crosby silt loam, 0 to 3 percent slopes, where trenches have been dug for foundation footings.**

impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the

lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

*Sanitary landfills* are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

*Daily cover for landfill* is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

## Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

*Roadfill* is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

*Sand and gravel* are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

*Topsoil* is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

## Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

*Pond reservoir areas* hold water behind a dam or embankment (fig. 12). Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

*Aquifer-fed excavated ponds* are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

*Drainage* is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

*Irrigation* is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

*Terraces and diversions* are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

*Grassed waterways* are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large

**Figure 12.—A pond reservoir embankment in an area of Martisco soils used for wetland wildlife habitat.**

stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

# Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

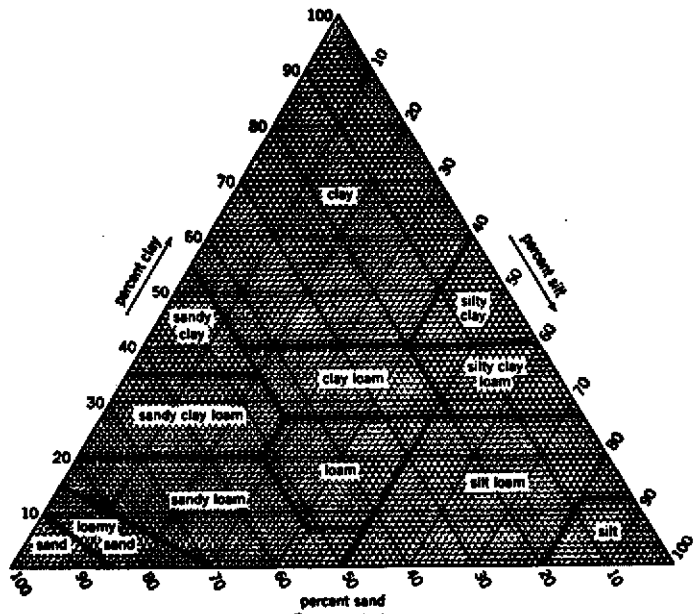



**Figure 13.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.**

## Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

*Depth* to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

*Texture* is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 13). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

*Classification* of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of

grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

*Rock fragments* larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

*Percentage (of soil particles) passing designated sieves* is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

*Liquid limit* and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

## Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

*Clay* as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

*Moist bulk density* is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

*Permeability* refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

*Available water capacity* refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

*Soil reaction* is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

*Shrink-swell potential* is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to

buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

*Erosion factor K* indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

*Erosion factor T* is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

*Wind erodibility groups* are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

*Organic matter* is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

## Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

*Hydrologic soil groups* are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second is for undrained areas.

*Flooding*, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

*High water table* (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

*Depth to bedrock* is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

*Potential frost action* is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

*Risk of corrosion* pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

# Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that have a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

## Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*5*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*6*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

### Celina Series

The Celina series consists of deep, moderately well drained, moderately slowly permeable soils on broad, undulating till plains. These soils formed in loess and in the underlying loamy glacial till. Slopes range from 1 to 6 percent.

Celina soils are adjacent to Crosby, Cyclone, and Miamian soils. Crosby soils are mottled in the subsurface layer, are somewhat poorly drained, and are in the lower lying, less sloping areas. Cyclone soils are poorly drained and are in depressions. Their surface layer is darker than that of the Celina soils. Miamian soils are well drained,

are in the higher lying landscape positions, and have a brown subsoil free of gray mottles.

Typical pedon of Celina silt loam, 1 to 6 percent slopes, eroded, in a cultivated field; 1,500 feet west and 1,800 feet south of the northeast corner of sec. 34, T. 18 N., R. 9 E.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam; weak medium granular structure; friable; common fine roots; medium acid; abrupt smooth boundary.

Bt1—9 to 15 inches; dark yellowish brown (10YR 4/6) clay loam; few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; common fine roots; thin discontinuous faint brown (10YR 5/3) clay films on faces of peds; few gray (10YR 6/1) silt coatings; common small iron and manganese oxide accumulations within the peds; medium acid; clear wavy boundary.

Bt2—15 to 20 inches; dark yellowish brown (10YR 4/6) clay loam; common medium distinct yellowish brown (10YR 5/8) and few medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; medium discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; few iron and manganese oxide accumulations within the peds; slightly acid; clear wavy boundary.

Bt3—20 to 24 inches; dark yellowish brown (10YR 4/4) clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak and moderate medium prismatic structure; firm; few fine roots; medium continuous very dark grayish brown (10YR 3/2) clay films on faces of peds; common iron and manganese oxide accumulations within the peds; about 5 percent gravel; neutral; clear wavy boundary.

Bt4—24 to 32 inches; yellowish brown (10YR 5/4) clay loam; common medium faint yellowish brown (10YR 5/6) mottles; weak medium prismatic and weak coarse subangular blocky structure; firm; few fine roots; thin discontinuous very dark grayish brown (10YR 3/2) and dark yellowish brown (10YR 3/4) clay films on faces of peds; about 10 percent gravel; slight effervescence; mildly alkaline; gradual irregular boundary.

C—32 to 60 inches; yellowish brown (10YR 5/4) loam; few medium distinct grayish brown (10YR 5/2) and few fine prominent reddish yellow (7.5YR 6/8) mottles; massive; firm; strong effervescence; moderately alkaline.

The solum is 20 to 40 inches thick. The loess mantle is less than 18 inches thick.

The A horizon has value of 4 or 5 and chroma of 2 or 3. The E horizon, if it occurs, has value of 5 and chroma of 3 to 6. It is silt loam, silty clay loam, or clay loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam, silty clay loam, clay, or silty clay. In some pedons it contains stones. It ranges from medium acid in the upper part to neutral in the lower part. The C horizon is brown (10YR 5/3), yellowish brown (10YR 5/4), or brown (7.5YR 4/4) silt loam or loam.

## Crosby Series

The Crosby series consists of deep, somewhat poorly drained, slowly permeable soils on broad, undulating moraines and in narrow, meandering drainageways in the uplands. These soils formed in a thin mantle of loess and in the underlying loamy glacial till. Slopes range from 0 to 3 percent.

Crosby soils are similar to Sleeth soils and are commonly adjacent to Cyclone, Losantville, Miamian, and Treaty soils. Sleeth soils have less clay in the subsoil than the Crosby soils. Their substratum is sand and gravelly coarse sand. Cyclone and Treaty soils are poorly drained and are in depressional areas. Their surface layer is darker than that of the Crosby soils. Also, they are grayer. Losantville soils are well drained and are on knobs and breaks between drainageways. They are shallower to carbonates than the Crosby soils. Miamian soils are well drained and are in the higher lying positions on the landscape.

Typical pedon of Crosby silt loam, 0 to 3 percent slopes, in a cultivated field; 2,375 feet east and 790 feet north of the southwest corner of sec. 31, T. 17 N., R. 11 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; moderate medium and fine granular structure; friable; medium acid; abrupt smooth boundary.

E—8 to 11 inches; dark grayish brown (10YR 4/2) silt loam; many medium faint pale brown (10YR 6/3) and yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; friable; few fine black (10YR 2/1) iron and manganese oxide accumulations; strongly acid; clear wavy boundary.

Bt1—11 to 14 inches; brown (10YR 5/3) silt loam; common medium distinct light gray (10YR 6/1) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; thin patchy light brownish gray (10YR 6/2) clay films on faces of some peds and lining voids in the inner part of peds; some continuous thin degraded coatings of clean silt grains on faces of peds; strongly acid; clear wavy boundary.

2Bt2—14 to 22 inches; brown (10YR 5/3) silty clay loam; common fine distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; thin continuous grayish brown (10YR 5/2) clay films on faces of peds; few iron and manganese oxide

accumulations; few pebbles; strongly acid; clear wavy boundary.

2Bt3—22 to 28 inches; yellowish brown (10YR 5/4) clay loam; many medium distinct gray (10YR 6/1) mottles; weak medium prismatic structure parting to moderate medium angular blocky; firm; gray (10YR 5/1) clay films on faces of peds; many black (10YR 2/1) iron and manganese oxide accumulations; few pebbles; medium acid; clear wavy boundary.

2C—28 to 60 inches; brown (10YR 5/3) loam; massive; friable; strong effervescence; moderately alkaline.

The solum is 20 to 38 inches thick, and the depth to carbonates is 18 to 36 inches. The loess mantle is less than 20 inches thick.

The A horizon has value of 4 or 5. The BA horizon, if it occurs, has value of 4 or 5 and chroma of 3 or 4. It is silt loam or silty clay loam. The Bt horizon has value of 4 to 6 and chroma of 2 to 6. The upper part is silt loam, silty clay loam, or clay loam, and the lower part is loam, silty clay, or clay loam. In some pedons the subsoil contains stones. Reaction is strongly acid to neutral in the E and Bt horizons. The C horizon is brown (10YR 5/3) or yellowish brown (10YR 5/4) loam, sandy loam, or clay loam.

## Cyclone Series

The Cyclone series consists of deep, poorly drained soils on glacial till plains. These soils formed in silty material and in the underlying glacial till. Permeability is moderate in the solum and moderately slow in the underlying glacial till. Slopes range from 0 to 2 percent.

These soils do not have an argillic horizon, which is definitive for the Cyclone series. This difference, however, does not alter the usefulness or behavior of the soils.

Cyclone soils are similar to Treaty soils and are commonly adjacent to Crosby soils. Treaty soils are shallower to loamy glacial till than the Cyclone soils. Crosby soils are in the slightly higher positions on the landscape, have a clayey subsoil, and are somewhat poorly drained.

Typical pedon of Cyclone silty clay loam, in a cultivated field; 500 feet west and 450 feet north of the southeast corner of sec. 34, T. 16 N., R. 11 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (2.5Y 5/2) dry; moderate medium granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

A—8 to 12 inches; very dark gray (10YR 3/1) silty clay loam; moderate medium subangular blocky structure; friable; many fine roots; neutral; clear smooth boundary.

Btg1—12 to 20 inches; dark gray (10YR 4/1) silty clay loam; few fine prominent strong brown (7.5YR 5/8) and yellowish brown (10YR 5/6) mottles; moderate fine and medium subangular blocky structure; firm; few fine roots; thin continuous very dark gray (10YR 3/1) clay films on faces of peds; neutral; clear smooth boundary.

Btg2—20 to 36 inches; gray (10YR 5/1) silty clay loam; many medium prominent strong brown (7.5YR 5/8) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark gray (10YR 4/1) clay films on faces of peds; neutral; clear smooth boundary.

Btg3—36 to 46 inches; gray (10YR 6/1) silty clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; thin continuous gray (10YR 5/1) clay films on faces of peds; neutral; clear smooth boundary.

2Bt—46 to 60 inches; yellowish brown (10YR 5/4) clay loam; common medium prominent gray (10YR 5/1) and common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; thin patchy dark gray (10YR 4/1) clay films on faces of peds; about 5 percent gravel; neutral; clear smooth boundary.

2C—60 to 80 inches; yellowish brown (10YR 5/4) loam; common medium distinct grayish brown (10YR 5/2) mottles; massive; firm; about 8 percent gravel; strong effervescence; mildly alkaline.

The thickness of the solum is 48 to 70 inches and coincides with the depth to free carbonates. The silty material is 40 to 60 inches thick.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is silty clay loam or silt loam. The Bt horizon has value of 4 or 5 and chroma of 1 to 3. The 2Bt horizon has value of 4 or 5 and chroma of 2 to 4. It is clay loam or loam. The C horizon has value of 4 or 5 and chroma of 2 to 4.

## Eldean Series

The Eldean series consists of well drained soils on outwash plains, terraces, and moraines. These soils formed in loamy outwash sediments that are moderately deep over sand and gravel. They are moderately permeable or moderately slowly permeable in the solum and rapidly permeable in the substratum. Slopes range from 0 to 35 percent.

Eldean soils are similar to Miamian soils and are commonly adjacent to Sleeth and Westland soils. Miamian soils are underlain by loamy glacial till. Sleeth soils are mottled throughout the Bt horizon, are in the lower lying landscape positions, and are somewhat poorly drained. Westland soils are very poorly drained and are in depressional areas. They have a surface layer that is darker than that of the Eldean soils. Also, they have grayer subhorizons.

Typical pedon of Eldean silt loam, 0 to 2 percent slopes, in a cultivated field; 500 feet west and 600 feet south of the northeast corner of sec. 23, T. 17 N., R. 9 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

E—7 to 10 inches; grayish brown (10YR 5/2) loam; weak thin and medium platy structure; friable; common fine roots; thin patchy very dark grayish brown (10YR 3/2) organic stains on faces of peds; slightly acid; clear wavy boundary.

Bt1—10 to 14 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; common fine roots; thin continuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 12 percent gravel; slightly acid; clear wavy boundary.

Bt2—14 to 22 inches; dark brown (7.5YR 4/4) clay; moderate medium subangular blocky structure; firm; common fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 12 percent gravel; strongly acid; clear wavy boundary.

Bt3—22 to 26 inches; dark reddish brown (5YR 3/4) sandy clay; weak medium subangular blocky structure; firm; common fine roots; thin continuous dark brown (10YR 3/3) clay films on faces of peds; about 10 percent gravel; strongly acid; clear wavy boundary.

Bt4—26 to 31 inches; dark reddish brown (5YR 3/3) gravelly sandy clay loam; weak medium subangular blocky structure; friable; common fine roots; thin patchy dark reddish brown (5YR 3/2) clay films on faces of peds; about 15 percent gravel; neutral; clear wavy boundary.

2C—31 to 60 inches; yellowish brown (10YR 5/4) gravelly coarse loamy sand; single grain; loose; strong effervescence; mildly alkaline.

The solum ranges from 20 to 40 inches in thickness. It is medium acid to neutral in the upper part and neutral or mildly alkaline in the lower part.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is clay loam or silt loam. Pedons in some cultivated areas do not have an E horizon. Some pedons have a BA horizon. The upper part of the Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 2 to 6. It is clay loam, clay, sandy clay, or the gravelly analogs of these textures. The BC horizon, if it occurs, and the lower part of the Bt horizon have hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 2 to 4. They are sandy loam, loam, clay loam, sandy clay loam, or the gravelly analogs of these textures. The content of coarse sand and gravel varies widely in the C horizon.

## Genesee Series

The Genesee series consists of deep, well drained, moderately permeable soils on bottom land. These soils formed in loamy alluvium. Slopes range from 0 to 2 percent.

Genesee soils are adjacent to Shoals and Sloan soils. Shoals soils are in the slightly lower positions on the landscape and are somewhat poorly drained. Sloan soils have gray colors throughout, are in depressional areas, and are very poorly drained.

Typical pedon of Genesee loam, occasionally flooded, in a cultivated field; 1,800 feet east and 400 feet north of the southwest corner of sec. 6, T. 16 N., R. 10 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, brown (10YR 4/3) crushed, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many fine roots; mildly alkaline; abrupt smooth boundary.

A—7 to 17 inches; dark grayish brown (10YR 4/2) loam, brown (10YR 4/3) crushed; moderate fine granular structure; friable; common fine roots; mildly alkaline; clear smooth boundary.

Bw1—17 to 26 inches; dark grayish brown (10YR 4/2) loam, dark brown (10YR 4/3) crushed; weak fine subangular blocky structure; friable; few fine roots; mildly alkaline; clear smooth boundary.

Bw2—26 to 37 inches; dark brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; few fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

C—37 to 60 inches; dark yellowish brown (10YR 4/4) stratified loam and sandy loam; massive; friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 45 inches. The A horizon has chroma of 2 or 3. It is dominantly loam, but the range includes silt loam and sandy loam. This horizon is slightly acid to mildly alkaline. The B horizon has value of 2 to 5 and chroma of 1 to 4. It is dominantly loam or silt loam, but in some pedons it has subhorizons of sandy loam. It is neutral or mildly alkaline. The C horizon has hue of 10YR, 7.5YR, or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is loam, silt loam, sandy loam, or the gravelly analogs of these textures and in some pedons is stratified. In some pedons it is stratified sand and gravel below a depth of 40 inches. It is mildly alkaline or moderately alkaline.

## Landes Series

The Landes series consists of deep, well drained soils on bottom land. These soils formed in loamy alluvium. Permeability is moderate in the solum and rapid in the substratum. Slopes range from 0 to 2 percent.

Landes soils are commonly adjacent to Losantville and Miamian soils on uplands. The adjacent soils have a clayey subsoil that is underlain by glacial till.

Typical pedon of Landes loam, rarely flooded, in a cultivated field; 800 feet west and 1,400 feet south of the northeast corner of sec. 31, T. 16 N., R. 12 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; few fine roots; neutral; abrupt smooth boundary.

A—9 to 23 inches; very dark grayish brown (10YR 3/2) loam; few fine distinct yellowish brown (10YR 5/4) mottles; moderate medium granular structure; friable; few fine roots; neutral; clear smooth boundary.

Bw—23 to 39 inches; yellowish brown (10YR 5/4) loam; few fine prominent strong brown (7.5YR 5/8) mottles; weak fine granular structure; friable; neutral; gradual smooth boundary.

C1—39 to 46 inches; yellowish brown (10YR 5/4) fine sandy loam; few medium prominent gray (10YR 5/1) mottles; moderate medium granular structure; friable; mildly alkaline; gradual smooth boundary.

C2—46 to 60 inches; brown (10YR 5/3) gravelly loamy coarse sand; loose; slight effervescence; moderately alkaline.

The solum ranges from 28 to 40 inches in thickness. It is slightly acid to moderately alkaline and may contain free carbonates.

The A horizon has value and chroma of 2 or 3. It is loam, sandy loam, or silt loam. The B horizon has value of 4 or 5 and chroma of 2 to 4. It is sandy loam, loamy sand, or loam. It has a clay content of less than 18 percent. The C horizon has value of 4 to 6 and chroma of 3. It is the gravelly analogs of sand, loamy fine sand, loamy coarse sand, fine sand, and sandy loam and commonly has strata of loam or silt loam.

## Losantville Series

The Losantville series consists of deep, well drained soils on glacial till plains and moraines. These soils formed in loamy glacial till. They are moderately permeable or moderately slowly permeable in the solum and slowly permeable in the underlying till. Slopes range from 2 to 30 percent.

Losantville soils are similar to Miamian soils and are commonly adjacent to Crosby soils. Miamian soils have a solum that is thicker than that of the Losantville soils. Crosby soils have gray mottles throughout the subsoil, are somewhat poorly drained, and are in the slightly lower positions on the landscape.

Typical pedon of Losantville silt loam, 2 to 6 percent slopes, eroded, in a cultivated field; 45 feet west and 738 feet south of the northeast corner of sec. 7, T. 16 N., R. 12 E.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; common fine and medium roots; about 4 percent gravel; neutral; abrupt smooth boundary.

2Bt1—7 to 12 inches; dark yellowish brown (10YR 4/4) clay; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; thin continuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 3 percent gravel; neutral; clear wavy boundary.

2Bt2—12 to 16 inches; dark yellowish brown (10YR 4/4) clay; moderate medium subangular blocky structure; firm; thin continuous dark brown (10YR 4/3) clay films on faces of peds; about 4 percent gravel; neutral; abrupt wavy boundary.

3C—16 to 60 inches; yellowish brown (10YR 5/4) loam; massive; friable; about 10 percent gravel; strong effervescence; moderately alkaline.

The solum ranges from 12 to 20 inches in thickness. The A horizon has value of 4 or 5 and chroma of 2 to 4. It is silt loam, loam, or clay loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. In some pedons it contains stones. The content of clay in this horizon is 35 to 45 percent. The C horizon has hue of 10YR, value of 5, and chroma of 3 to 6.

## Martisco Series

The Martisco series consists of deep, very poorly drained soils formed in a thin layer of highly decomposed organic material underlain by marl and by loamy outwash materials. The layer of marl is thin to thick, and the loamy material is at a depth of 3 to 5 feet. Permeability is moderate or moderately rapid in the organic material, slow in the marl, and moderately rapid in the loamy material. These soils are in depressions and on the lowest parts of outwash plains along Little Buck Creek, Buck Creek, Fall Creek, and the Big Blue River. Slopes range from 0 to 2 percent.

Martisco soils are commonly adjacent to the mineral Cyclone, Millgrove, and Westland soils. The adjacent soils are slightly higher on the landscape than the Martisco soils.

Typical pedon of Martisco muck, drained, in a cultivated field; 200 feet west and 1,480 feet north of the southeast corner of sec. 33, T. 19 N., R. 10 E.

Op—0 to 8 inches; black (N 2/0), broken face and rubbed, sapric material, very dark gray (N 3/0) dry; less than 5 percent fiber, a trace rubbed; weak medium subangular blocky structure; friable; about 50 percent mineral material; neutral; abrupt smooth boundary.

Oa—8 to 15 inches; black (N 2/0), broken face and rubbed, sapric material, very dark gray (N 3/0) dry;

less than 5 percent fiber, a trace rubbed; common coarse and medium distinct gray (10YR 5/1) mottles; weak coarse prismatic and moderate medium subangular blocky structure; friable; about 50 percent mineral material; neutral; clear smooth boundary.

2Ckg—15 to 27 inches; light brownish gray (2.5Y 6/2) marl; common medium distinct strong brown (7.5YR 5/6) mottles occurring as patches and vertical streaks; massive; sticky; common shell fragments; strong effervescence; moderately alkaline; gradual irregular boundary.

3Cg1—27 to 38 inches; gray (N 5/0) gravelly loam; massive; sticky; about 20 percent coarse fragments; strong effervescence; moderately alkaline; gradual irregular boundary.

3Cg2—38 to 60 inches; gray (10YR 5/1) very gravelly sandy loam that has thin strata of silty material; massive; very friable; about 50 percent gravel; strong effervescence; moderately alkaline.

The thickness of the sapric material ranges from 8 to 16 inches and commonly coincides with the thickness of the plow layer. The Op horizon is black (10YR 2/1 or N 2/0). It is 8 to 10 inches thick. Some pedons do not have an Oa horizon. This horizon is similar to the Op horizon. The 2Ck horizon has hue of 10YR to 5Y, value of 5 to 8, and chroma of 2 or less. The upper part of the 3C horizon is gravelly loam, gravelly sandy loam, or silty clay loam. The lower part has hue of 10YR, value of 5 or 6, and chroma of 1 to 3. It commonly has thin strata of sand, gravelly coarse sand, or silty material.

## Miami Series

The Miami series consists of deep, well drained, moderately permeable soils on till plains. These soils formed in a thin mantle of loess and in the underlying loamy glacial till. Slopes range from 0 to 6 percent.

Miami soils are adjacent to Crosby, Cyclone, and Treaty soils. Crosby soils are somewhat poorly drained and are in the slightly lower positions on the landscape. Their subsoil has gray mottles throughout and is clayey. Cyclone and Treaty soils are poorly drained and are in depressional areas. Their surface layer is thicker and darker than that of the Miami soils. Also, their subsoil is grayer.

Typical pedon of Miami silt loam, gravelly substratum, 2 to 6 percent slopes, eroded, in a cultivated field; 413 feet north and 165 feet east of the southwest corner of sec. 31, T. 16 N., R. 10 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; many fine roots; neutral; clear smooth boundary.

E—10 to 15 inches; brown (10YR 5/3) silt loam; moderate medium granular structure; friable; common fine roots; neutral; clear wavy boundary.

Bt1—15 to 21 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; thin discontinuous dark brown (10YR 4/3) clay films on faces of peds; few fine roots; slightly acid; clear smooth boundary.

2Bt2—21 to 28 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium and coarse subangular blocky structure; firm; thin continuous dark brown (10YR 4/3) clay films on faces of peds; few fine roots; medium acid; clear wavy boundary.

2Bt3—28 to 33 inches; dark yellowish brown (10YR 4/4) clay loam; weak coarse subangular blocky structure; firm; thin discontinuous very dark grayish brown (10YR 3/2) clay films on faces of peds; slightly acid; clear wavy boundary.

2Bt4—33 to 39 inches; brown (10YR 5/3) clay loam; weak coarse subangular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; neutral; clear irregular boundary.

2C—39 to 60 inches; yellowish brown (10YR 5/4) loam; massive; firm; about 6 percent gravel; slight effervescence; moderately alkaline.

The thickness of the solum commonly is 37 to 42 inches but ranges from 27 to 58 inches. The depth to free carbonates ranges from 24 to 52 inches. The loess mantle is 7 to 27 inches thick.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is medium acid to neutral. The E, if it occurs, has value of 4 or 5 and chroma of 3 to 5. It is silt loam, silty clay loam, or clay loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly clay loam, but in some pedons it has individual subhorizons of silty clay loam. It is strongly acid to neutral. The BC horizon, if it occurs, is loam or clay loam. It ranges from slightly acid to mildly alkaline. The C horizon is brown (10YR 5/3) or yellowish brown (10YR 5/4 and 5/6) loam.

## Miamian Series

The Miamian series consists of deep, well drained, moderately slowly permeable soils on broad, undulating till plains and along drainageways and streams. These soils formed in a thin mantle of loess and in the underlying loamy glacial till. Slopes range from 2 to 6 percent.

Miamian soils are similar to Eldean and Losantville soils and are commonly adjacent to Crosby, Cyclone, and Treaty soils. Eldean soils are moderately deep to sand and gravel. Losantville soils are shallower to loamy glacial till than the Miamian soils. Crosby soils have gray mottles throughout the subsoil, are somewhat poorly

drained, and are in the slightly lower positions on the landscape. Cyclone and Treaty soils are poorly drained and are in depressional areas. Their surface layer is thicker and darker than that of the Miamian soils. Also, their subsoil is grayer.

Typical pedon of Miamian silt loam, 2 to 6 percent slopes, eroded, in a cultivated field; 1,500 feet west and 1,800 feet south of the northeast corner of sec. 34, T. 18 N., R. 9 E.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; weak medium granular structure; friable; common fine roots; medium acid; abrupt smooth boundary.

Bt1—9 to 15 inches; dark yellowish brown (10YR 4/6) clay loam; moderate medium subangular blocky structure; firm; common fine roots; thin discontinuous brown (10YR 5/3) clay films on faces of peds; few gray (10YR 6/1) silt coatings; medium acid; clear wavy boundary.

2Bt2—15 to 20 inches; dark yellowish brown (10YR 4/6) clay; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous dark brown (10YR 4/3) clay films on faces of peds; slightly acid; clear wavy boundary.

2Bt3—20 to 24 inches; dark yellowish brown (10YR 4/4) clay loam; weak and moderate medium prismatic structure; firm; few fine roots; thin continuous dark brown (10YR 3/3) clay films on faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

2Bt4—24 to 32 inches; yellowish brown (10YR 5/4) clay loam; common medium faint yellowish brown (10YR 5/6) mottles; weak medium prismatic and weak coarse subangular blocky structure; firm; few fine roots; thin discontinuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 10 percent gravel; slight effervescence; mildly alkaline; gradual irregular boundary.

2C—32 to 60 inches; yellowish brown (10YR 5/4) loam; few medium distinct grayish brown (10YR 5/2) and few fine prominent reddish yellow (7.5YR 6/8) mottles; massive; friable; strong effervescence; moderately alkaline.

The solum is 22 to 36 inches thick, and the depth to carbonates is 18 to 36 inches. The loess mantle is less than 18 inches thick.

The A horizon has value of 4 or 5 and chroma of 2 or 3. The BA horizon, if it occurs, has value of 4 or 5 and chroma of 3 or 4. It is silt loam, silty clay loam, or clay loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam, silty clay loam, clay, or silty clay. In some pedons it contains stones. It ranges from medium acid in the upper part to neutral in the lower part. The C horizon is brown (10YR 5/3) or yellowish brown (10YR 5/4) silt loam or loam.

## Millgrove Series

The Millgrove series consists of deep, very poorly drained, moderately permeable soils on terraces and drainageways along minor glacial streams. These soils formed in loamy, water-laid deposits over stratified, gravelly and loamy deposits of varying thickness. Slopes range from 0 to 2 percent.

These soils do not have an argillic horizon, which is definitive for Millgrove series. This difference, however, does not alter the usefulness or behavior of the soils.

Millgrove soils are similar to Westland soils and are commonly adjacent to Crosby and Sleeth soils. Westland soils are more than 40 inches deep to loose sand and gravel. Crosby and Sleeth soils are in the slightly higher positions on the landscape and are somewhat poorly drained. The substratum of Crosby soils is loamy glacial till, and that of Sleeth soils is loose sand and gravel.

Typical pedon of Millgrove loam, in a cultivated field; 1,800 feet north and 175 feet west of the southeast corner of sec. 1, T. 17 N., R. 8 E.

Ap—0 to 7 inches; very dark gray (10YR 3/1) loam, grayish brown (2.5Y 5/2) dry; moderate fine granular structure; friable; few fine roots; about 2 percent gravel; neutral; abrupt smooth boundary.

A—7 to 12 inches; very dark gray (10YR 3/1) clay loam; moderate medium subangular blocky structure; firm; few fine roots; about 2 percent gravel; neutral; clear smooth boundary.

Btg1—12 to 17 inches; grayish brown (2.5Y 5/2) clay loam; few fine distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; about 2 percent gravel; neutral; clear smooth boundary.

Btg2—17 to 24 inches; dark gray (10YR 4/1) clay loam; few medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark gray (10YR 4/1) clay films on faces of peds; about 2 percent gravel; neutral; clear wavy boundary.

Btg3—24 to 32 inches; dark gray (10YR 4/1) loam; few fine distinct very dark gray (10YR 3/1) and many medium distinct yellowish brown (10YR 5/6) mottles; weak fine and medium subangular blocky structure; friable; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 10 percent gravel; neutral; abrupt wavy boundary.

Btg4—32 to 36 inches; dark gray (10YR 4/1) loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films; about 5 percent gravel; neutral; abrupt wavy boundary.

2C—36 to 60 inches; grayish brown (10YR 5/2) gravelly loam; common medium distinct brownish yellow (10YR 6/6) mottles; massive; friable; some thin layers of silt and coarse sand; about 18 percent gravel; mild effervescence; moderately alkaline.

The solum ranges from 30 to 50 inches in thickness. The A horizon has value of 2 or 3 and chroma of 1 or 2. It is clay loam, loam, silty clay loam, or silt loam. It is neutral to medium acid. The Btg horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It is clay loam, sandy clay loam, loam, and the gravelly analogs of these textures. It is slightly acid to mildly alkaline. The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is gravelly sandy loam or gravelly loam. A considerable amount of fine textured material is mixed and stratified with the gravelly and sandy deposits.

## Shoals Series

The Shoals series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in loamy alluvial sediments. Slopes range from 0 to 2 percent.

Shoals soils are commonly adjacent to Genesee and Sloan soils. Genesee soils are browner throughout than the Shoals soils, are well drained, and are in the slightly higher positions on the landscape. Sloan soils have a mollic surface layer and are grayer throughout than the Shoals soils. They are very poorly drained.

Typical pedon of Shoals loam, occasionally flooded, in a cultivated field; 1,320 feet west and 660 feet south of the northeast corner of sec. 12, T. 16 N., R. 9 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, brown (10YR 5/3) dry; weak fine granular structure; friable; many fine roots; mildly alkaline; abrupt smooth boundary.

C1—8 to 13 inches; dark grayish brown (10YR 4/2) loam; common medium faint dark gray (10YR 4/1) and common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium granular structure; friable; common fine roots; mildly alkaline; clear smooth boundary.

C2—13 to 20 inches; dark brown (10YR 4/3) loam; many medium faint dark grayish brown (10YR 4/2) and common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure parting to weak fine subangular blocky; friable; few fine roots; moderately alkaline; clear smooth boundary.

Cg1—20 to 30 inches; grayish brown (10YR 5/2) loam; many medium prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; slight effervescence; moderately alkaline; clear smooth boundary.

Cg2—30 to 43 inches; grayish brown (10YR 5/2) loam; many medium prominent yellowish brown (10YR 5/6) and common medium distinct dark gray (10YR 4/1) mottles; massive; friable; strong effervescence; moderately alkaline; gradual smooth boundary.

Cg3—43 to 49 inches; gray (10YR 5/1) stratified loam, sandy loam, and loamy sand; many medium prominent yellowish brown (10YR 5/6) and common medium faint grayish brown (10YR 5/2) mottles; massive; friable; about 3 percent gravel; strong effervescence; moderately alkaline; gradual smooth boundary.

Cg4—49 to 60 inches; gray (10YR 5/1) stratified silt loam, loam, sandy loam, and loamy sand; common medium prominent yellowish brown (10YR 5/4) and many medium faint dark gray (10YR 4/1) mottles; massive; friable; about 9 percent gravel; strong effervescence; mildly alkaline.

In many pedons free carbonates are below a depth of 30 inches, but in some pedons they are as shallow as 20 inches. The Ap horizon has value of 4 or 5 and chroma of 2. It is silt loam or loam. The C horizon has value of 5 or 6 and chroma of 1 to 3. It is neutral or mildly alkaline. The upper part of this horizon is dominantly silt loam or loam, and the lower part is stratified silt loam, loam, sandy loam, and loamy sand.

## Sleeth Series

The Sleeth series consists of deep, somewhat poorly drained soils on broad terraces. These soils formed in loamy outwash over calcareous, stratified sand and gravel. They are moderately permeable in the solum and very rapidly permeable in the substratum. Slopes range from 0 to 2 percent.

Sleeth soils are similar to Crosby soils and are commonly adjacent to Eldean and Westland soils. Crosby soils have a substratum of loamy glacial till. Eldean soils have brighter colors throughout the solum than the Sleeth soils, are well drained, and are in the higher positions on the landscape. Westland soils are in depressional areas and are very poorly drained. Their surface layer is darker than that of the Sleeth soils. Also, their subsoil is grayer.

Typical pedon of Sleeth silt loam, in a pasture; 2,300 feet west and 400 feet south of the northeast corner of sec. 24, T. 16 N., R. 10 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many medium and fine roots; neutral; abrupt smooth boundary.

E—10 to 13 inches; grayish brown (10YR 5/2) loam; few medium distinct yellowish brown (10YR 5/6) mottles; weak fine granular structure; friable; common fine

roots; about 2 percent gravel; slightly acid; clear smooth boundary.

Bt—13 to 20 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct grayish brown (10YR 5/2) and common medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous grayish brown (10YR 5/2) clay films; about 5 percent gravel; slightly acid; clear smooth boundary.

Btg1—20 to 32 inches; grayish brown (10YR 5/2) clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous grayish brown (10YR 5/2) clay films; about 5 percent gravel; medium acid; clear smooth boundary.

Btg2—32 to 42 inches; grayish brown (10YR 5/2) clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; thin continuous dark gray (10YR 4/1) clay films; about 8 percent gravel; neutral; clear smooth boundary.

Btg3—42 to 46 inches; grayish brown (10YR 5/2) loam; few medium prominent yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; thin patchy dark gray (10YR 4/1) clay films; about 10 percent gravel; neutral; clear smooth boundary.

2Cg—46 to 60 inches; grayish brown (10YR 5/2) stratified sand and gravelly coarse sand; single grain; loose; about 25 percent gravel; mildly alkaline; strong effervescence.

The solum is 40 to 50 inches thick. The A horizon has chroma of 2 or 3. It is silt loam or loam. It is neutral or slightly acid. Some pedons do not have an E horizon. The Bt and Btg horizons have value of 4 to 6 and chroma of 1 to 4. They are clay loam, sandy clay loam, or gravelly clay loam. The Bt horizon and the upper part of the Btg horizon are medium acid or slightly acid. The lower part of the Btg horizon is slightly acid or neutral. Some pedons have a BC horizon.

## Sloan Series

The Sloan series consists of deep, very poorly drained, moderately permeable or moderately slowly permeable soils on flood plains. These soils formed in alluvial sediments. Slopes range from 0 to 2 percent.

Sloan soils are similar to Westland soils and are commonly adjacent to Genesee and Shoals soils. Westland soils are on outwash plains and terraces and have a C horizon of sand and gravel. Genesee and Shoals soils are browner in the solum than the Sloan soils and are in the slightly higher positions on the landscape. Genesee soils are well drained, and Shoals soils are somewhat poorly drained.

Typical pedon of Sloan silty clay loam, occasionally flooded, in a cultivated field; 578 feet north and 660 feet west of the southeast corner of sec. 1, T. 16 N., R. 9 E.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (2.5Y 5/2) dry; moderate fine angular blocky structure; friable; many fine roots; neutral; abrupt smooth boundary.

A—7 to 13 inches; very dark grayish brown (10YR 3/2) silty clay loam; few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium angular blocky structure; friable; many fine roots; neutral; gradual wavy boundary.

Bg1—13 to 20 inches; dark gray (10YR 4/1) silty clay loam; common medium distinct brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; firm; common fine roots; neutral; gradual wavy boundary.

Bg2—20 to 32 inches; gray (10YR 5/1) silty clay loam; many medium distinct brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; firm; few fine roots; neutral; clear smooth boundary.

2Bg3—32 to 40 inches; gray (10YR 5/1) stratified loam, clay loam, and sandy clay loam; many coarse prominent strong brown (7.5YR 5/6) mottles; massive; friable; neutral; gradual wavy boundary.

2Cg—40 to 60 inches; dark gray (10YR 4/1) stratified gravelly loam, silt loam, silty clay loam, and sandy loam; many coarse distinct strong brown (7.5YR 5/6) mottles; massive; friable; about 7 percent gravel; neutral.

The solum ranges from 32 to 48 inches in thickness. It is neutral or mildly alkaline.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is silty clay loam or silt loam. Some pedons have a BA horizon. This horizon is silt loam or silty clay loam. The Bg and 2Bg horizons have value of 4 or 5 and chroma of 1 or 2. They are silty clay loam, clay loam, or silt loam and have strata of loam, sandy clay loam, or gravelly sandy loam in some pedons. The 2Cg horizon is stratified silt loam, silty clay loam, loam, sandy loam, or the gravelly analogs of these textures.

## Treaty Series

The Treaty series consists of deep, poorly drained soils on glacial till plains and moraines. These soils formed in silty material and in the underlying glacial till. Permeability is moderate in the solum and moderately slow in the underlying glacial till. Slopes range from 0 to 2 percent.

Treaty soils are similar to Cyclone soils and are commonly adjacent to Crosby and Miamian soils. Cyclone soils have a silty mantle that is thicker than that of the Treaty soils. Crosby soils are in the slightly higher positions on the landscape, have a clayey subsoil, and

are somewhat poorly drained. Miamian soils are in the higher positions on the landscape, have a clayey subsoil, and are well drained.

Typical pedon of Treaty silt loam, stony subsoil, in a pasture; 2,310 feet north and 15 feet west of the center of sec. 33, T. 19 N., R. 11 E.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine subangular blocky structure; friable; many fine roots; neutral; abrupt smooth boundary.

A—8 to 12 inches; very dark gray (10YR 3/1) silty clay loam; weak fine and medium angular blocky structure; friable; common fine roots; neutral; clear smooth boundary.

Btg1—12 to 25 inches; dark gray (10YR 4/1) silty clay loam; few fine distinct yellowish brown (10YR 5/8) mottles; moderate medium angular blocky structure; firm; few fine roots; thin continuous dark gray (10YR 4/1) clay films on faces of peds; one stone 14 inches in diameter; neutral; clear smooth boundary.

2Btg2—25 to 36 inches; gray (10YR 5/1) clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark gray (10YR 4/1) clay films on faces of peds; about 8 percent gravel; neutral; clear smooth boundary.

2BCg—36 to 51 inches; yellowish brown (10YR 5/6) loam; many medium prominent gray (10YR 5/1) mottles; weak coarse subangular blocky structure; friable; about 10 percent gravel; mildly alkaline; gradual wavy boundary.

2Cg—51 to 60 inches; brown (10YR 5/3) loam; few fine distinct gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; massive; about 10 percent gravel; strong effervescence; mildly alkaline.

The solum is 42 to 60 inches thick. The silty mantle is 24 to 40 inches thick.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is silt loam or silty clay loam. The Bt horizon has value of 4 or 5. The 2Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is clay loam or loam. The 2BCg horizon also is clay loam or loam. It has value of 4 to 6 and chroma of 3 to 6. The 2Cg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4.

## Washtenaw Series

The Washtenaw series consists of deep, poorly drained soils in potholes, along the edges of valleys, and in drainageways on till plains and outwash plains. These soils formed in alluvium and in the underlying glacial drift. They are moderately permeable in the upper part and slowly permeable in the lower part. Slopes range from 0 to 2 percent.

These soils have lower chroma in the upper 30 inches than is definitive for the Washtenaw series. This difference, however, does not alter the usefulness or behavior of the soils.

Washtenaw soils are similar to Westland soils and are commonly adjacent to Crosby, Losantville, and Miamian soils. Westland soils have a surface soil that is thicker and darker than that of the Washtenaw soils. Crosby soils are in the slightly higher landscape positions, have gray mottles throughout the subsoil, and are somewhat poorly drained. Losantville and Miamian soils are in the higher landscape positions and are well drained. They are browner throughout the solum than the Washtenaw soils.

Typical pedon of Washtenaw silt loam, in a cultivated field; 1,650 feet west and 1,485 feet south of the northeast corner of sec. 9, T. 16 N., R. 9 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium platy structure; friable; common fine roots; neutral; abrupt smooth boundary.

C—8 to 20 inches; dark gray (10YR 4/1) silt loam; weak medium granular structure; friable; common fine roots; slightly acid; clear wavy boundary.

2Ab—20 to 23 inches; very dark gray (10YR 3/1) silty clay loam; few fine faint pale brown (10YR 6/3) mottles; moderate fine and medium subangular blocky structure; friable; few fine roots; slightly acid; clear smooth boundary.

2Btgb1—23 to 33 inches; gray (10YR 5/1) silty clay loam; common fine and medium distinct strong brown (7.5YR 5/6) and few medium distinct dark brown (7.5YR 4/4) mottles; moderate medium and coarse subangular blocky structure; firm; few fine roots; thin continuous dark gray (N 4/0) clay films on faces of peds; slightly acid; clear wavy boundary.

2Btgb2—33 to 45 inches; olive gray (5Y 5/2) clay loam; many medium prominent strong brown (7.5YR 5/8) and few medium faint light gray (10YR 7/1) mottles; weak medium subangular blocky structure; firm; few fine roots; thin continuous weak red (2.5YR 4/2) clay films on faces of peds and lining voids; slightly acid; clear wavy boundary.

2Btgb3—45 to 50 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct strong brown (7.5YR 5/8) and common medium faint light gray (10YR 7/1) mottles; weak medium subangular blocky structure; firm; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; dark gray (5Y 4/1) pockets of sandy loam; neutral; clear wavy boundary.

2C—50 to 60 inches; yellowish brown (10YR 5/4) loam; common medium faint dark yellowish brown (10YR 4/6) mottles; massive; firm; thin discontinuous gray (10YR 5/1) clay films lining voids; about 2 percent gravel; strong effervescence; moderately alkaline.

The thickness of the overwash ranges from 20 to 40 inches. Reaction ranges from medium acid to mildly alkaline to a depth of 40 inches and from slightly acid to moderately alkaline below that depth.

The Ap horizon has value of 3 to 5 and chroma of 2 to 4. It is silt loam or loam. The C horizon also is silt loam or loam. It has value of 4 to 6 and chroma of 2 or less. The 2Ab horizon has value of 2 or 3 and chroma of 1 or 2. It is loam, silt loam, silty clay loam, or clay loam. The 2Btgb horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 2 or less. It is clay loam or silty clay loam. The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5, and chroma of 1 to 4.

## Westland Series

The Westland series consists of deep, very poorly drained soils on outwash plains, terraces, and valley trains. These soils formed in loamy outwash and in the underlying gravelly outwash. They are moderately permeable in the solum and very rapidly permeable in the substratum. Slopes range from 0 to 2 percent.

Westland soils are similar to Millgrove, Sloan, and Washtenaw soils and are commonly adjacent to Eldean and Sleeth soils. Millgrove soils are underlain by gravelly sandy loam or gravelly loam. Sloan soils are on flood plains and have a C horizon of stratified gravelly loam. Washtenaw soils formed in alluvial sediments over glacial outwash. Eldean soils are browner or redder throughout the solum than the Westland soils, are well drained, and are in the higher positions on the landscape. Sleeth soils have gray mottles throughout the subsoil, are somewhat poorly drained, and are in the slightly higher positions on the landscape.

Typical pedon of Westland silt loam, in a cultivated field; 660 feet west and 1,320 feet north of the southeast corner of sec. 22, T. 18 N., R. 11 E.

Ap—0 to 10 inches; very dark grayish brown (2.5Y 3/2) silt loam, grayish brown (2.5Y 5/2) dry; weak medium subangular blocky structure; friable; few fine roots; neutral; abrupt smooth boundary.

Btg1—10 to 20 inches; dark grayish brown (10YR 4/2) clay loam; common medium and coarse distinct yellowish brown (10YR 5/6) mottles; moderate medium and weak coarse subangular blocky structure; firm; few fine roots; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; about 3 percent gravel; neutral; clear smooth boundary.

Btg2—20 to 30 inches; dark grayish brown (10YR 4/2) clay loam; many medium and coarse distinct yellowish brown (10YR 5/6) mottles; moderate coarse angular blocky structure; firm; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; about 10 percent gravel; neutral; clear smooth boundary.

2BCg—30 to 45 inches; grayish brown (10YR 5/2) gravelly sandy clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; about 15 percent gravel; neutral; clear smooth boundary.

2Cg—45 to 60 inches; grayish brown (10YR 5/2) gravelly coarse sand; single grain; about 30 percent gravel; loose; strong effervescence; mildly alkaline.

The solum is 40 to 55 inches thick. The A horizon is black (N 2/0) to very dark grayish brown (10YR 3/2). It is loam, silt loam, or silty clay loam. It is neutral or slightly acid. The Btg and 2BCg horizons have hue of 10YR, 5Y, or 2.5Y, value of 4 to 6, and chroma of 2 or less. They are clay loam, silty clay loam, or sandy clay loam. They are neutral or slightly acid.

# Formation of the Soils

This section relates the major factors of soil formation to the soils in the county. It also describes the processes of soil formation.

## Factors of Soil Formation

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Some time is always required for the differentiation of soil horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effects of any one factor unless conditions are specified for the other four.

### Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the limits of the chemical and mineralogical composition of the soil. The parent materials of the soils in Henry County were deposited by glaciers or by meltwater from the glaciers. Some of these materials were reworked and redeposited by the subsequent actions of water and wind. The glaciers covered the county for thousands of years and finally retreated about 20,000 years ago. Although the parent materials are all of glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant parent materials in Henry County were deposited as glacial till, outwash, lacustrine material, alluvium, and organic material.

*Glacial till* is material laid down directly by a glacier with a minimum of water action. It consists of particles of different sizes that are mixed together. Some of the small pebbles in glacial till have sharp edges and corners, indicating that they have not been worn by water. The glacial till in Henry County is calcareous, friable or firm loam. Miamian soils are an example of soils that formed in glacial till. These soils typically are moderately fine textured and have well developed structure.

*Outwash material* was deposited by running water from melting glaciers. The size of the particles that make up outwash varies according to the velocity of the water that carried the material. When the water slowed down, the coarser particles were deposited first. Finer particles, such as very fine sand, silt, and clay, were carried farther by the more slowly moving water. Outwash deposits generally occur as layers of particles of similar size, such as sandy loam, sand, gravel, and other coarse particles (fig. 14). Eldean soils are an example of soils that formed in outwash material.

*Lacustrine material* was deposited from still, or ponded, glacial meltwater. Because the coarser fragments dropped out of moving water as outwash, only the finer particles, such as very fine sand, silt, and clay, remained to settle out in still water. Lacustrine deposits are mainly silty or clayey. In Henry County, the soils that formed in lacustrine deposits are typically medium textured or moderately fine textured. Cyclone soils are an example.

*Alluvium* was deposited recently by floodwater along present streams. This material varies in texture, depending on the speed of the water from which it was deposited. Genesee and Sloan soils are examples of soils that formed in alluvium.

*Organic material* is made up of deposits of plant remains. After the glaciers withdrew from the area, water was left standing in depressions in outwash plains and till plains. Grasses and sedges growing around the edges of these lakes died, and their remains fell to the bottom. Because of wetness, the plant remains did not decompose quickly. Later, white cedar and other water-tolerant trees grew in the areas. As these trees died, their remains became part of the organic accumulation. The lakes were eventually filled with organic material. The plant remains subsequently decomposed to form muck in many areas. In other areas the material has

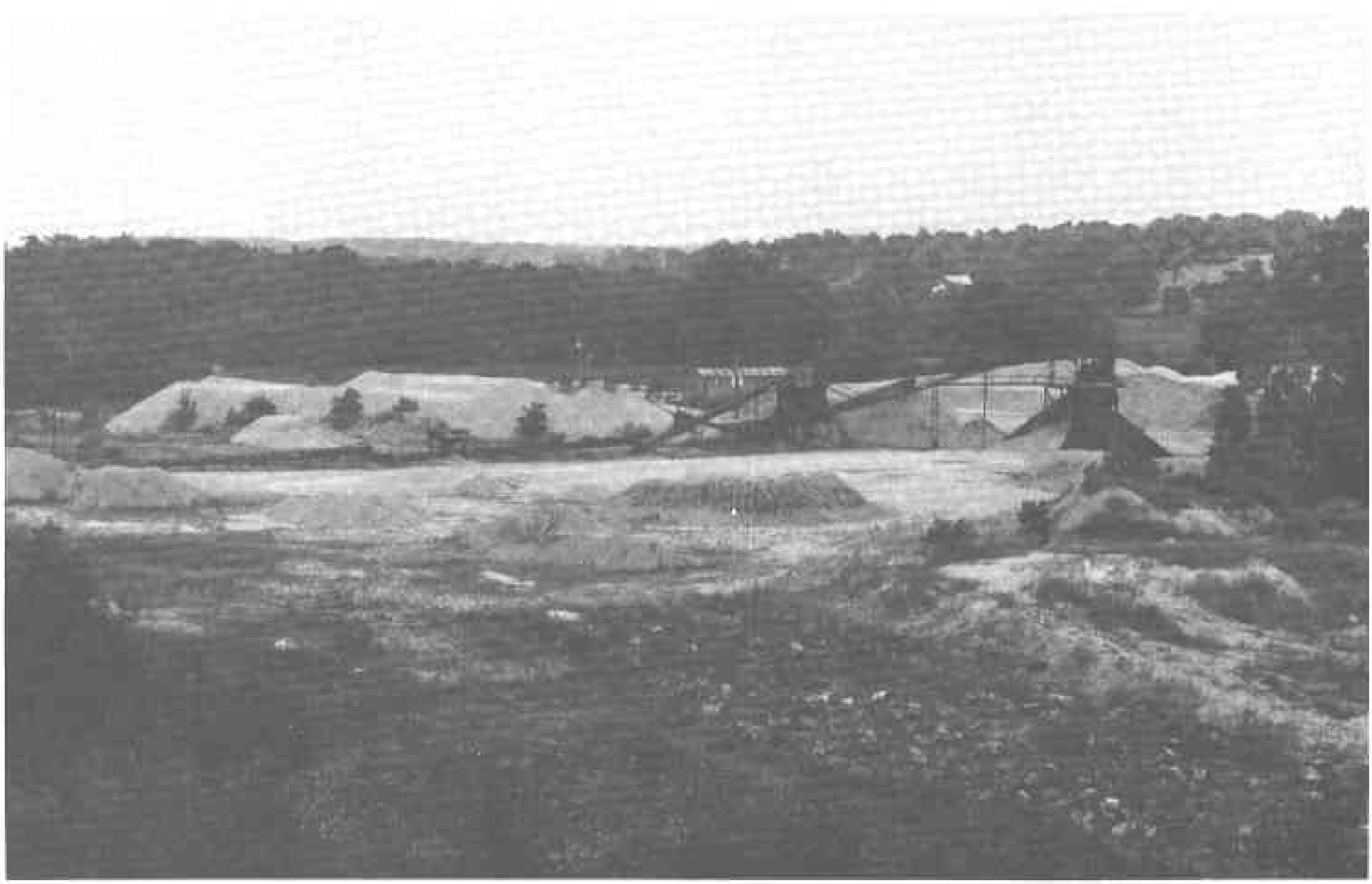


**Figure 14.—Deposits of sand and gravel in an outwash area near the Big Blue River.**

changed little since deposition and remains as peat. Martisco soils are an example of mucky soils that formed in organic material.

### Plant and Animal Life

Plants have been the principal organisms influencing the soils in Henry County. Bacteria, fungi, and earthworms, however, have also been important. The chief contribution of plant and animal life to soil formation is the addition of organic matter and nitrogen to the soil. The kind of organic material on and in the soil depends on the kinds of plants that grew on the soil in the past. In some areas the partially decayed remains of the plants accumulated on the surface and eventually became humus. The roots of the plants provided channels for the downward movement of water and air through the soil and added organic matter as they decayed. Bacteria helped to break down the organic matter into plant nutrients.

The native vegetation in Henry County was mainly deciduous trees. Differences in natural soil drainage and minor variations in the parent material have affected the composition of the forest species. The well drained upland soils, such as Miamian and Losantville soils, were covered mainly with sugar maple, beech, yellow-poplar, white oak, red oak, and ash. The soils on bottom land were covered with yellow-poplar, black walnut, and white ash. The poorly drained soils supported primarily swamp white oak, bur oak, maple, and cottonwood. In a few wet areas, sphagnum and other mosses contributed substantially to the accumulation of organic matter. Cyclone and Westland soils formed under wet conditions and contain relatively large amounts of organic matter.

### Climate

Climate helps to determine the kind of plant and animal life on and in the soil, the amount of water available for the weathering of minerals and the transporting of weathered products, and the rate of chemical reactions in the soil.

The climate in Henry County is cool and humid. It is presumably similar to the climate under which the soils formed. The soils in this county differ from those that formed under a dry, warm climate and from those that formed under a hot, moist climate. Climate is uniform throughout the county, although its effect is modified locally by runoff and landscape position. Only minor differences among the soils are the result of differences in climate. More information about the climate is available under the heading "General Nature of the County."

### Relief

Relief has markedly affected the soils in Henry County through its effect on natural drainage, runoff erosion, plant cover, and soil temperature. Slopes range from 0 to 35 percent. Runoff is most rapid on the steeper slopes. Water is temporarily ponded in low areas.

Natural soil drainage in the county ranges from well drained on the ridgetops to very poorly drained in the depressions. Through its effect on aeration in the soil, drainage determines the color of the soil. Water and air move freely through well drained soils but slowly through very poorly drained soils. In Miamian and other well drained, well aerated soils, the iron compounds that give most soils their color are brightly colored and oxidized. Cyclone and other poorly aerated, poorly drained soils are dull gray and mottled.

### Time

Usually a long time is needed for the processes of soil formation to form distinct horizons in the parent material. Differences in in length of time that the parent material has been in place are commonly reflected in the degree of profile development. Some soils form rapidly. Others form slowly.

The soils in Henry County range from young to mature. The glacial deposits in which many of the soils formed have been exposed to the soil-forming factors for a long enough time to allow distinct horizons to form. Some soils, however, have not been in place long enough for the development of distinct horizons. Sloan and other young soils that formed in recent alluvial material are examples.

## Processes of Soil Formation

Several processes have been involved in the formation of the soils in Henry County. These processes are the accumulation of organic matter; the dissolution, transfer, and removal of calcium carbonates and bases; the liberation and translocation of silicate clay minerals; and the reduction and transfer of iron. In most soils more than one of these processes have helped to differentiate horizons.

Some organic matter has accumulated in the surface layer of all the soils in the county. The organic matter content of some soils is low, but that of others is high. Generally, the soils that have the most organic matter, such as Cyclone and Westland soils, have a thick, black surface layer.

Carbonates and bases have been leached from the upper horizons of nearly all the soils in the county. Leaching probably preceded the translocation of silicate clay minerals. Most of the carbonates and some of the bases have been leached from the A and B horizons of well drained soils. Even in the wettest soils, some leaching is indicated by the absence of carbonates and by an acid or neutral reaction. Leaching of wet soils is slow because of a high water table or the slow movement of water through the profile.

Clay accumulates in pores and other voids and forms films on the surfaces along which water moves. The leaching of bases and the translocation of silicate clay minerals are among the more important processes of horizon differentiation in the county. Miamian soils are an example of soils in which translocated silicate clay minerals in the form of clay films have accumulated in an argillic horizon.

Gleying, or the reduction and transfer of iron, has occurred in all of the very poorly drained, poorly drained, and somewhat poorly drained soils in the county. In the naturally wet soils, this process has significantly affected horizon differentiation. It is evidenced by a gray or dull color in the subsoil. Reduction is commonly accompanied by some transfer of iron, either from upper horizons to lower ones or completely out of the profile. Mottles, spots, or flecks of one color in a background of another color indicate the segregation of iron.

# References

(1) American Association of State Highway and Transportation Officials. 1982. Standard specifications for highway materials and methods of sampling and testing. Ed. 13, 2 vols., illus.

(2) American Society for Testing and Materials. 1985. Standard test method for classification of soils for engineering purposes. ASTM Stand. D 2487.

(3) Conservation Needs Committee. 1968. Indiana soil and water conservation needs inventory. 224 pp., illus.

(4) Soil Erosion Assessment Committee. 1979. Agricultural erosion assessment for the nondesignated and designated 208 planning areas of Indiana. 393 pp., illus.

(5) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(6) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(7) United States Department of Commerce, Bureau of the Census. 1981. 1980 census of population and housing, preliminary reports, Indiana. 18 pp.

# Glossary

**ABC soil.** A soil having an A, a B, and a C horizon.

**Aeration, soil.** The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

**Aggregate, soil.** Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

**Alluvium.** Material, such as sand, silt, or clay, deposited on land by streams.

**Area reclaim** (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

**Association, soil.** A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

**Available water capacity (available moisture capacity).** The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

| | *Inches* |
|---|---|
| Very low | 0 to 3 |
| Low | 3 to 6 |
| Moderate | 6 to 9 |
| High | 9 to 12 |
| Very high | more than 12 |

**Base saturation.** The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

**Bottom land.** The normal flood plain of a stream, subject to flooding.

**Cation.** An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

**Cation-exchange capacity.** The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

**Chiseling.** Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

**Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

**Clay film.** A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

**Claypan.** A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

**Coarse fragments.** If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

**Coarse textured soil.** Sand or loamy sand.

**Cobblestone (or cobble).** A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

**Colluvium.** Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

**Complex slope.** Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

**Conservation tillage.** A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

**Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

*Loose.*—Noncoherent when dry or moist; does not hold together in a mass.

*Friable.*—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

*Firm.*—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

*Plastic.*—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
*Sticky.*—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
*Hard.*—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
*Soft.*—When dry, breaks into powder or individual grains under very slight pressure.
*Cemented.*—Hard; little affected by moistening.

**Contour stripcropping.** Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

**Control section.** The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

**Corrosive.** High risk of corrosion to uncoated steel or deterioration of concrete.

**Cover crop.** A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

**Cutbanks cave** (in tables). The walls of excavations tend to cave in or slough.

**Deferred grazing.** Postponing grazing or resting grazing land for a prescribed period.

**Dense layer** (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

**Diversion (or diversion terrace).** A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

**Drainage class** (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
*Excessively drained.*—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
*Somewhat excessively drained.*—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
*Well drained.*—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
*Moderately well drained.*—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
*Somewhat poorly drained.*—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
*Poorly drained.*—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
*Very poorly drained.*—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

**Drainage, surface.** Runoff, or surface flow of water, from an area.

**Eluviation.** The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

**Eolian soil material.** Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

**Erosion.** The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
*Erosion* (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
*Erosion* (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

**Excess fines** (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

**Fast intake** (in tables). The rapid movement of water into the soil.

**Fertility, soil.** The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

**Field moisture capacity.** The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

**Fine textured soil.** Sandy clay, silty clay, and clay.

**First bottom.** The normal flood plain of a stream, subject to frequent or occasional flooding.

**Flood plain.** A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

**Foot slope.** The inclined surface at the base of a hill.

**Frost action** (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

**Genesis, soil.** The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

**Glacial drift** (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

**Glacial outwash** (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

**Glacial till** (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

**Glaciofluvial deposits** (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

**Glaciolacustrine deposits.** Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

**Gleyed soil.** Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

**Grassed waterway.** A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

**Gravel.** Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

**Gravelly soil material.** Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

**Green manure crop** (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

**Ground water** (geology). Water filling all the unblocked pores of underlying material below the water table.

**Gully.** A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

**Hardpan.** A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

**Hemic soil material (mucky peat).** Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

**Horizon, soil.** A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:
*O horizon.*—An organic layer of fresh and decaying plant residue.
*A horizon.*—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.
*E horizon.*—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.
*B horizon.*—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C

horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

*C horizon.*—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

*Cr horizon.*—Soft, consolidated bedrock beneath the soil.

*R layer.*—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

**Humus.** The well decomposed, more or less stable part of the organic matter in mineral soils.

**Hydrologic soil groups.** Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

**Illuviation.** The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

**Infiltration.** The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

**Infiltration capacity.** The maximum rate at which water can infiltrate into a soil under a given set of conditions.

**Infiltration rate.** The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

**Intake rate.** The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

| | |
|---|---|
| Less than 0.2 | very low |
| 0.2 to 0.4 | low |
| 0.4 to 0.75 | moderately low |
| 0.75 to 1.25 | moderate |
| 1.25 to 1.75 | moderately high |
| 1.75 to 2.5 | high |
| More than 2.5 | very high |

**Irrigation.** Application of water to soils to assist in production of crops. Methods of irrigation are—

*Border.*—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

*Basin.*—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

*Controlled flooding.*—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

*Corrugation.*—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

*Drip (or trickle).*—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

*Furrow.*—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

*Sprinkler.*—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

*Subirrigation.*—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

*Wild flooding.*—Water, released at high points, is allowed to flow onto an area without controlled distribution.

**Kame** (geology). An irregular, short ridge or hill of stratified glacial drift.

**Lacustrine deposit** (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

**Leaching.** The removal of soluble material from soil or other material by percolating water.

**Liquid limit.** The moisture content at which the soil passes from a plastic to a liquid state.

**Loam.** Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

**Loess.** Fine grained material, dominantly of silt-sized particles, deposited by wind.

**Low strength.** The soil is not strong enough to support loads.

**Medium textured soil.** Very fine sandy loam, loam, silt loam, or silt.

**Mineral soil.** Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

**Minimum tillage.** Only the tillage essential to crop production and prevention of soil damage.

**Miscellaneous area.** An area that has little or no natural soil and supports little or no vegetation.

**Moderately coarse textured soil.** Coarse sandy loam, sandy loam, and fine sandy loam.

**Moderately fine textured soil.** Clay loam, sandy clay loam, and silty clay loam.

**Moraine** (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

**Morphology, soil.** The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

**Mottling, soil.** Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

**Muck.** Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

**Munsell notation.** A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

**Neutral soil.** A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

**Nutrient, plant.** Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

**Organic matter.** Plant and animal residue in the soil in various stages of decomposition.

**Outwash plain.** A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

**Pan.** A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

**Parent material.** The unconsolidated organic and mineral material in which soil forms.

**Peat.** Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material).

**Ped.** An individual natural soil aggregate, such as a granule, a prism, or a block.

**Pedon.** The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

**Percolation.** The downward movement of water through the soil.

**Percs slowly** (in tables). The slow movement of water through the soil adversely affecting the specified use.

**Permeability.** The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

| | |
|---|---|
| Very slow | less than 0.06 inch |
| Slow | 0.06 to 0.2 inch |
| Moderately slow | 0.2 to 0.6 inch |
| Moderate | 0.6 inch to 2.0 inches |
| Moderately rapid | 2.0 to 6.0 inches |
| Rapid | 6.0 to 20 inches |
| Very rapid | more than 20 inches |

**Phase, soil.** A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

**pH value.** A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

**Plasticity index.** The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

**Plastic limit.** The moisture content at which a soil changes from semisolid to plastic.

**Plowpan.** A compacted layer formed in the soil directly below the plowed layer.

**Ponding.** Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

**Poorly graded.** Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

**Poor filter** (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

**Productivity, soil.** The capability of a soil for producing a specified plant or sequence of plants under specific management.

**Profile, soil.** A vertical section of the soil extending through all its horizons and into the parent material.

**Reaction, soil.** A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

| | *pH* |
|---|---|
| Extremely acid | below 4.5 |
| Very strongly acid | 4.5 to 5.0 |
| Strongly acid | 5.1 to 5.5 |
| Medium acid | 5.6 to 6.0 |
| Slightly acid | 6.1 to 6.5 |
| Neutral | 6.6 to 7.3 |
| Mildly alkaline | 7.4 to 7.8 |
| Moderately alkaline | 7.9 to 8.4 |
| Strongly alkaline | 8.5 to 9.0 |
| Very strongly alkaline | 9.1 and higher |

**Relief.** The elevations or inequalities of a land surface, considered collectively.

**Rill.** A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

**Rooting depth** (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

**Root zone.** The part of the soil that can be penetrated by plant roots.

**Runoff.** The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

**Sand.** As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

**Sapric soil material (muck).** The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

**Seepage** (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

**Series, soil.** A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

**Sheet erosion.** The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

**Shrink-swell.** The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

**Silt.** As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

**Similar soils.** Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

**Site index.** A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

**Slope.** The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multipled by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

**Slope** (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

**Slow refill** (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

**Small stones** (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

**Soil.** A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

**Soil separates.** Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

| | *Millimeters* |
|---|---|
| Very coarse sand | 2.0 to 1.0 |
| Coarse sand | 1.0 to 0.5 |
| Medium sand | 0.5 to 0.25 |
| Fine sand | 0.25 to 0.10 |
| Very fine sand | 0.10 to 0.05 |
| Silt | 0.05 to 0.002 |
| Clay | less than 0.002 |

**Solum.** The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

**Stones.** Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

**Stony.** Refers to a soil containing stones in numbers that interfere with or prevent tillage.

**Stripcropping.** Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

**Structure, soil.** The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

**Stubble mulch.** Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

**Subsoil.** Technically, the B horizon; roughly, the part of the solum below plow depth.

**Subsoiling.** Breaking up a compact subsoil by pulling a special chisel through the soil.

**Substratum.** The part of the soil below the solum.

**Subsurface layer.** Any surface soil horizon (A, E, AB, or EB) below the surface layer.

**Summer fallow.** The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

**Surface layer.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

**Surface soil.** The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

**Taxadjuncts.** Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

**Terminal moraine.** A belt of thick glacial drift that generally marks the termination of important glacial advances.

**Terrace.** An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

**Terrace** (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

**Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

**Thin layer** (in tables). Otherwise suitable soil material too thin for the specified use.

**Till plain.** An extensive flat to undulating area underlain by glacial till.

**Tilth, soil.** The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

**Toe slope.** The outermost inclined surface at the base of a hill; part of a foot slope.

**Topsoil.** The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

**Trace elements.** Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

**Upland** (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

**Valley fill.** In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

**Weathering.** All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

**Well graded.** Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

**Wilting point (or permanent wilting point).** The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

# Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data were recorded in the period 1951-74 at Cambridge City, Indiana]

| Month | Temperature | | | | | | Precipitation | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average daily maximum | Average daily minimum | Average daily | 2 years in 10 will have-- Maximum temperature higher than-- | 2 years in 10 will have-- Minimum temperature lower than-- | Average number of growing degree days* | Average | 2 years in 10 will have-- Less than-- | 2 years in 10 will have-- More than-- | Average number of days with 0.10 inch or more | Average snowfall |
| | °F | °F | °F | °F | °F | Units | In | In | In | | In |
| January---- | 35.0 | 15.8 | 25.4 | 65 | -16 | 16 | 2.32 | 1.42 | 3.11 | 6 | 5.1 |
| February--- | 37.4 | 17.5 | 27.5 | 65 | -8 | 14 | 2.03 | .82 | 3.04 | 5 | 4.7 |
| March------ | 47.5 | 26.9 | 37.2 | 80 | 3 | 126 | 3.34 | 1.56 | 4.86 | 7 | 4.9 |
| April------ | 62.4 | 38.7 | 50.6 | 84 | 20 | 318 | 3.98 | 1.87 | 5.79 | 7 | .6 |
| May-------- | 72.8 | 48.1 | 60.5 | 90 | 29 | 636 | 4.72 | 2.41 | 6.72 | 9 | .0 |
| June------- | 81.6 | 56.7 | 69.2 | 95 | 41 | 876 | 4.12 | 2.05 | 5.91 | 7 | .0 |
| July------- | 85.4 | 60.2 | 72.8 | 96 | 45 | 1,017 | 4.32 | 2.05 | 6.26 | 7 | .0 |
| August----- | 84.9 | 57.7 | 71.3 | 96 | 43 | 970 | 2.85 | 1.35 | 4.14 | 6 | .0 |
| September-- | 78.6 | 50.9 | 64.8 | 95 | 31 | 744 | 3.01 | 1.33 | 4.44 | 6 | .0 |
| October---- | 65.1 | 38.6 | 51.9 | 85 | 19 | 369 | 2.83 | .99 | 4.34 | 6 | .1 |
| November--- | 50.3 | 29.7 | 40.0 | 75 | 10 | 77 | 3.31 | 1.92 | 4.54 | 7 | 1.5 |
| December--- | 40.0 | 22.5 | 31.3 | 68 | -6 | 35 | 3.15 | 1.47 | 4.58 | 6 | 4.8 |
| Yearly: | | | | | | | | | | | |
| Average-- | 61.8 | 38.6 | 50.2 | --- | --- | --- | --- | --- | --- | --- | --- |
| Extreme-- | --- | --- | --- | 98 | -17 | --- | --- | --- | --- | --- | --- |
| Total---- | --- | --- | --- | --- | --- | 5,198 | 39.98 | 33.17 | 43.40 | 79 | 21.7 |

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Data were recorded in the period 1951-74 at Cambridge City, Indiana]

| Probability | Temperature | | |
|---|---|---|---|
| | $24^{\circ}$ F or lower | $28^{\circ}$ F or lower | $32^{\circ}$ F or lower |
| Last freezing temperature in spring: | | | |
| 1 year in 10 later than-- | Apr. 15 | May 3 | May 18 |
| 2 years in 10 later than-- | Apr. 11 | Apr. 28 | May 13 |
| 5 years in 10 later than-- | Apr. 4 | Apr. 19 | May 4 |
| First freezing temperature in fall: | | | |
| 1 year in 10 earlier than-- | Oct. 18 | Oct. 5 | Sept. 23 |
| 2 years in 10 earlier than-- | Oct. 22 | Oct. 9 | Sept. 27 |
| 5 years in 10 earlier than-- | Oct. 30 | Oct. 18 | Oct. 5 |

TABLE 3.--GROWING SEASON

[Data were recorded in the period 1951-74 at Cambridge City, Indiana]

| Probability | Daily minimum temperature during growing season | | |
|---|---|---|---|
| | Higher than $24^{\circ}$ F | Higher than $28^{\circ}$ F | Higher than $32^{\circ}$ F |
| | Days | Days | Days |
| 9 years in 10 | 192 | 163 | 138 |
| 8 years in 10 | 197 | 169 | 144 |
| 5 years in 10 | 209 | 181 | 154 |
| 2 years in 10 | 220 | 193 | 164 |
| 1 year in 10 | 226 | 199 | 169 |

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

| Map symbol | Soil name | Acres | Percent |
|---|---|---|---|
| CeB2 | Celina silt loam, 1 to 6 percent slopes, eroded | 20,500 | 8.1 |
| CfB2 | Celina silt loam, stony subsoil, 1 to 6 percent slopes, eroded | 800 | 0.3 |
| CrA | Crosby silt loam, 0 to 3 percent slopes | 51,500 | 20.6 |
| CsA | Crosby silt loam, stony subsoil, 0 to 3 percent slopes | 3,900 | 1.5 |
| Cy | Cyclone silty clay loam | 51,350 | 20.3 |
| EdA | Eldean silt loam, 0 to 2 percent slopes | 11,200 | 4.4 |
| EdB2 | Eldean silt loam, 2 to 6 percent slopes, eroded | 6,100 | 2.4 |
| EdC2 | Eldean silt loam, 6 to 12 percent slopes, eroded | 800 | 0.3 |
| EdD2 | Eldean silt loam, 12 to 18 percent slopes, eroded | 650 | 0.3 |
| EdE2 | Eldean silt loam, 18 to 35 percent slopes, eroded | 750 | 0.3 |
| ExC3 | Eldean clay loam, 6 to 12 percent slopes, severely eroded | 1,600 | 0.6 |
| ExD3 | Eldean clay loam, 12 to 18 percent slopes, severely eroded | 420 | 0.2 |
| Ge | Genesee loam, occasionally flooded | 2,400 | 1.0 |
| La | Landes loam, rarely flooded | 1,000 | 0.4 |
| LeB2 | Losantville silt loam, 2 to 6 percent slopes, eroded | 3,300 | 1.3 |
| LeC2 | Losantville silt loam, 6 to 12 percent slopes, eroded | 4,700 | 1.9 |
| LeD2 | Losantville silt loam, 12 to 18 percent slopes, eroded | 2,500 | 1.0 |
| LeE2 | Losantville silt loam, 18 to 30 percent slopes, eroded | 1,800 | 0.7 |
| LhC3 | Losantville clay loam, 6 to 12 percent slopes, severely eroded | 8,200 | 3.2 |
| LhD3 | Losantville clay loam, 12 to 18 percent slopes, severely eroded | 1,700 | 0.7 |
| LsB2 | Losantville silt loam, stony subsoil, 2 to 6 percent slopes, eroded | 1,100 | 0.4 |
| LsC2 | Losantville silt loam, stony subsoil, 6 to 12 percent slopes, eroded | 1,200 | 0.5 |
| LsD2 | Losantville silt loam, stony subsoil, 12 to 18 percent slopes, eroded | 460 | 0.2 |
| LsE2 | Losantville silt loam, stony subsoil, 18 to 30 percent slopes, eroded | 200 | 0.1 |
| LxC3 | Losantville clay loam, stony subsoil, 6 to 12 percent slopes, severely eroded | 1,300 | 0.5 |
| LxD3 | Losantville clay loam, stony subsoil, 12 to 18 percent slopes, severely eroded | 340 | 0.1 |
| Ma | Martisco muck, drained | 1,600 | 0.6 |
| MlA | Miami silt loam, gravelly substratum, 0 to 2 percent slopes | 6,600 | 2.6 |
| MlB2 | Miami silt loam, gravelly substratum, 2 to 6 percent slopes, eroded | 7,100 | 2.8 |
| MmB2 | Miamian silt loam, 2 to 6 percent slopes, eroded | 29,000 | 11.5 |
| MoB2 | Miamian silt loam, stony subsoil, 2 to 6 percent slopes, eroded | 3,300 | 1.3 |
| Mx | Millgrove loam | 5,000 | 2.0 |
| Ot | Orthents and Aquents, loamy | 699 | 0.3 |
| Pt | Pits, gravel | 450 | 0.2 |
| Sg | Shoals loam, occasionally flooded | 1,800 | 0.7 |
| Sk | Sleeth silt loam | 1,500 | 0.6 |
| Sn | Sloan silty clay loam, occasionally flooded | 1,300 | 0.5 |
| Ts | Treaty silt loam, stony subsoil | 2,500 | 1.0 |
| Wb | Washtenaw silt loam | 1,600 | 0.6 |
| We | Westland silt loam | 9,700 | 3.8 |
| | Water areas more than 40 acres in size | 490 | 0.2 |
| | Water areas less than 40 acres in size | 90 | * |
| | Total | 252,499 | 100.0 |

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

| Map symbol | Soil name |
|---|---|
| CeB2 | Celina silt loam, 1 to 6 percent slopes, eroded |
| CfB2 | Celina silt loam, stony subsoil, 1 to 6 percent slopes, eroded |
| CrA | Crosby silt loam, 0 to 3 percent slopes (where drained) |
| CsA | Crosby silt loam, stony subsoil, 0 to 3 percent slopes (where drained) |
| Cy | Cyclone silty clay loam (where drained) |
| EdA | Eldean silt loam, 0 to 2 percent slopes |
| EdB2 | Eldean silt loam, 2 to 6 percent slopes, eroded |
| Ge | Genesee loam, occasionally flooded |
| La | Landes loam, rarely flooded |
| LeB2 | Losantville silt loam, 2 to 6 percent slopes, eroded |
| LsB2 | Losantville silt loam, stony subsoil, 2 to 6 percent slopes, eroded |
| MlA | Miami silt loam, gravelly substratum, 0 to 2 percent slopes |
| MlB2 | Miami silt loam, gravelly substratum, 2 to 6 percent slopes, eroded |
| MmB2 | Miamian silt loam, 2 to 6 percent slopes, eroded |
| MoB2 | Miamian silt loam, stony subsoil, 2 to 6 percent slopes, eroded |
| Mx | Millgrove loam (where drained) |
| Sg | Shoals loam, occasionally flooded (where drained) |
| Sk | Sleeth silt loam (where drained) |
| Sn | Sloan silty clay loam, occasionally flooded (where drained) |
| Ts | Treaty silt loam, stony subsoil (where drained) |
| Wb | Washtenaw silt loam (where drained) |
| We | Westland silt loam (where drained) |

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

| Soil name and map symbol | Land capability | Corn | Soybeans | Winter wheat | Bromegrass-alfalfa hay | Tall fescue |
|---|---|---|---|---|---|---|
| | | Bu | Bu | Bu | Tons | AUM* |
| CeB2 Celina | IIe | 105 | 40 | 45 | 4.5 | 9.0 |
| CfB2 Celina | IIe | 90 | 35 | 40 | 4.1 | 8.2 |
| CrA Crosby | IIw | 110 | 40 | 50 | 3.4 | 6.8 |
| CsA Crosby | IIw | 90 | 32 | 40 | 3.0 | 6.0 |
| Cy Cyclone | IIw | 155 | 54 | 55 | 5.1 | 10.2 |
| EdA Eldean | IIs | 110 | 35 | 42 | 4.5 | 9.0 |
| EdB2 Eldean | IIe | 100 | 35 | 40 | 4.5 | 9.0 |
| EdC2 Eldean | IIIe | 85 | 25 | 35 | 4.0 | 8.0 |
| EdD2 Eldean | IVe | 80 | 20 | 30 | 3.5 | 7.0 |
| EdE2 Eldean | VIe | --- | --- | --- | 3.0 | 6.0 |
| ExC3 Eldean | IVe | 75 | 20 | 30 | 3.5 | 7.0 |
| ExD3 Eldean | VIe | --- | --- | --- | 3.0 | 6.0 |
| Ge Genesee | IIw | 105 | 30 | --- | 4.0 | 8.0 |
| La Landes | IIs | 99 | 34 | 45 | 3.7 | 7.4 |
| LeB2 Losantville | IIe | 90 | 36 | 42 | 3.7 | 7.4 |
| LeC2 Losantville | IIIe | 80 | 32 | 38 | 3.2 | 6.4 |
| LeD2 Losantville | IVe | 70 | 28 | 33 | 3.2 | 6.4 |
| LeE2 Losantville | VIe | --- | --- | --- | 2.5 | 5.0 |
| LhC3 Losantville | IVe | 60 | 24 | 28 | 2.6 | 5.2 |
| LhD3 Losantville | VIe | --- | --- | --- | 2.0 | 4.0 |

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

| Soil name and map symbol | Land capability | Corn | Soybeans | Winter wheat | Bromegrass-alfalfa hay | Tall fescue |
|---|---|---|---|---|---|---|
| | | Bu | Bu | Bu | Tons | AUM* |
| LsB2---------------------- Losantville | IIe | 80 | 30 | 38 | 3.2 | 6.4 |
| LsC2---------------------- Losantville | IIIe | 70 | 25 | 33 | 2.8 | 5.6 |
| LsD2---------------------- Losantville | IVe | 60 | 22 | 30 | 2.8 | 5.6 |
| LsE2---------------------- Losantville | VIe | --- | --- | --- | 2.5 | 5.0 |
| LxC3---------------------- Losantville | IVe | 50 | 20 | 25 | 2.4 | 4.8 |
| LxD3---------------------- Losantville | VIe | --- | --- | --- | 2.0 | 4.0 |
| Ma------------------------ Martisco | IVw | 80 | --- | --- | --- | --- |
| MlA----------------------- Miami | I | 105 | 40 | 45 | 5.0 | 9.0 |
| MlB2---------------------- Miami | IIe | 90 | 35 | 40 | 4.5 | 9.0 |
| MmB2---------------------- Miamian | IIe | 110 | 36 | 50 | 4.5 | 9.0 |
| MoB2---------------------- Miamian | IIe | 100 | 30 | 45 | 4.0 | 8.0 |
| Mx------------------------ Millgrove | IIw | 130 | 50 | 50 | 5.0 | 10.0 |
| Ot. Orthents and Aquents | | | | | | |
| Pt**. Pits | | | | | | |
| Sg------------------------ Shoals | IIw | 130 | 46 | 52 | 4.3 | 8.6 |
| Sk------------------------ Sleeth | IIw | 120 | 42 | 48 | 4.0 | 8.0 |
| Sn------------------------ Sloan | IIIw | 126 | 42 | 45 | 5.0 | 10.0 |
| Ts------------------------ Treaty | IIw | 130 | 45 | 55 | 4.2 | 8.4 |
| Wb------------------------ Washtenaw | IIw | 130 | 46 | 52 | 4.3 | 8.6 |
| We------------------------ Westland | IIw | 140 | 49 | 56 | 4.6 | 9.2 |

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

| Class | Total acreage | Major management concerns (Subclass) | | | |
|---|---|---|---|---|---|
| | | Erosion (e) | Wetness (w) | Soil problem (s) | Climate (c) |
| | | Acres | Acres | Acres | Acres |
| I | 6,600 | --- | --- | --- | --- |
| II | 214,650 | 71,200 | 131,250 | 12,200 | --- |
| III | 8,000 | 6,700 | 1,300 | --- | --- |
| IV | 16,310 | 14,710 | 1,600 | --- | --- |
| V | --- | --- | --- | --- | --- |
| VI | 5,210 | 5,210 | --- | --- | --- |
| VII | --- | --- | --- | --- | --- |
| VIII | --- | --- | --- | --- | --- |

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

| Soil name and map symbol | Ordination symbol | Management concerns: Erosion hazard | Management concerns: Equipment limitation | Management concerns: Seedling mortality | Management concerns: Windthrow hazard | Potential productivity: Common trees | Potential productivity: Site index | Trees to plant |
|---|---|---|---|---|---|---|---|---|
| CeB2, CfB2: Celina | 5a | Slight | Slight | Slight | Slight | Northern red oak | 90 | Eastern white pine, black walnut, red pine, yellow-poplar, white ash, northern red oak. |
| | | | | | | Yellow-poplar | 110 | |
| | | | | | | White oak | --- | |
| | | | | | | Black walnut | --- | |
| | | | | | | Black cherry | --- | |
| | | | | | | Sugar maple | --- | |
| | | | | | | White ash | --- | |
| CrA, CsA: Crosby | 4a | Slight | Slight | Slight | Slight | White oak | 75 | Eastern white pine, northern red oak, white ash, red maple, yellow-poplar, American sycamore. |
| | | | | | | Pin oak | 85 | |
| | | | | | | Yellow-poplar | 85 | |
| | | | | | | Northern red oak | 75 | |
| Cy: Cyclone | 5w | Slight | Severe | Severe | Severe | Pin oak | 90 | Eastern white pine, red maple, white ash. |
| | | | | | | White oak | 75 | |
| EdA, EdB2, EdC2: Eldean | 4a | Slight | Slight | Slight | Slight | Northern red oak | 80 | Eastern white pine, black walnut, yellow-poplar, white ash, red pine, white oak. |
| | | | | | | Black oak | 80 | |
| | | | | | | White oak | 80 | |
| | | | | | | Black walnut | --- | |
| | | | | | | Black cherry | --- | |
| | | | | | | Sugar maple | --- | |
| | | | | | | White ash | --- | |
| | | | | | | Yellow-poplar | --- | |
| EdD2, EdE2: Eldean | 4r | Moderate | Moderate | Slight | Slight | Northern red oak | 80 | Eastern white pine, black walnut, yellow-poplar, white ash, red pine, white oak. |
| | | | | | | Black oak | 80 | |
| | | | | | | White oak | 80 | |
| | | | | | | Black walnut | --- | |
| | | | | | | Black cherry | --- | |
| | | | | | | Sugar maple | --- | |
| | | | | | | White ash | --- | |
| | | | | | | Yellow-poplar | --- | |
| ExC3: Eldean | 4a | Slight | Slight | Slight | Slight | Northern red oak | 80 | Eastern white pine, black walnut, yellow-poplar, white ash, red pine, white oak. |
| | | | | | | Black oak | 80 | |
| | | | | | | White oak | 80 | |
| | | | | | | Black walnut | --- | |
| | | | | | | Black cherry | --- | |
| | | | | | | Sugar maple | --- | |
| | | | | | | White ash | --- | |
| | | | | | | Yellow-poplar | --- | |
| ExD3: Eldean | 4r | Moderate | Moderate | Slight | Slight | Northern red oak | 80 | Eastern white pine, black walnut, yellow-poplar, white ash, red pine, white oak. |
| | | | | | | Black oak | 80 | |
| | | | | | | White oak | 80 | |
| | | | | | | Black walnut | --- | |
| | | | | | | Black cherry | --- | |
| | | | | | | Sugar maple | --- | |
| | | | | | | White ash | --- | |
| | | | | | | Yellow-poplar | --- | |
| Ge: Genesee | 8a | Slight | Slight | Slight | Slight | Yellow-poplar | 100 | Eastern white pine, black walnut, yellow-poplar, black locust. |

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

| Soil name and map symbol | Ordination symbol | Management concerns | | | | Potential productivity | | Trees to plant |
|---|---|---|---|---|---|---|---|---|
| | | Erosion hazard | Equipment limitation | Seedling mortality | Windthrow hazard | Common trees | Site index | |
| La-------------- Landes | 7a | Slight | Slight | Slight | Slight | Yellow-poplar-------<br>Eastern cottonwood--<br>American sycamore---<br>Green ash----------- | 96<br>106<br>---<br>--- | Eastern cottonwood, yellow-poplar, American sycamore, green ash, black walnut, eastern white pine, sugar maple. |
| LeB2, LeC2------ Losantville | 4a | Slight | Slight | Slight | Slight | White oak-----------<br>Northern red oak---- | 75<br>80 | Eastern white pine, yellow-poplar, black walnut. |
| LeD2, LeE2------ Losantville | 4r | Moderate | Moderate | Slight | Slight | White oak-----------<br>Northern red oak---- | 75<br>80 | Eastern white pine, yellow-poplar, black walnut. |
| LhC3------------ Losantville | 4a | Slight | Slight | Slight | Slight | White oak-----------<br>Northern red oak---- | 75<br>80 | Eastern white pine, yellow-poplar, black walnut. |
| LhD3------------ Losantville | 4r | Moderate | Moderate | Slight | Slight | White oak-----------<br>Northern red oak---- | 75<br>80 | Eastern white pine, yellow-poplar, black walnut. |
| LsB2, LsC2------ Losantville | 4a | Slight | Slight | Slight | Slight | White oak-----------<br>Northern red oak---- | 75<br>80 | Eastern white pine, yellow-poplar, black walnut. |
| LsD2, LsE2------ Losantville | 4r | Moderate | Moderate | Slight | Slight | White oak-----------<br>Northern red oak---- | 75<br>80 | Eastern white pine, yellow-poplar, black walnut. |
| LxC3------------ Losantville | 4a | Slight | Slight | Slight | Slight | White oak-----------<br>Northern red oak---- | 75<br>80 | Eastern white pine, yellow-poplar, black walnut. |
| LxD3------------ Losantville | 4r | Moderate | Moderate | Slight | Slight | White oak-----------<br>Northern red oak---- | 75<br>80 | Eastern white pine, yellow-poplar, black walnut. |
| Ma-------------- Martisco | 2w | Slight | Severe | Severe | Severe | Red maple-----------<br>Green ash-----------<br>Quaking aspen-------<br>Black willow--------<br>Silver maple-------- | 55<br>55<br>56<br>---<br>--- | |
| MlA, MlB2------- Miami | 5a | Slight | Slight | Slight | Slight | White oak-----------<br>Yellow-poplar------- | 90<br>98 | Yellow-poplar, white ash, black walnut, red pine, white oak. |
| MmB2, MoB2------ Miamian | 5a | Slight | Slight | Slight | Slight | Northern red oak----<br>Black walnut--------<br>White oak-----------<br>Yellow-poplar-------<br>Black cherry--------<br>Sugar maple---------<br>White ash----------- | 87<br>---<br>---<br>---<br>---<br>---<br>--- | Eastern white pine, black walnut, yellow-poplar, white ash, red pine, northern red oak, white oak. |

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

| Soil name and map symbol | Ordination symbol | Management concerns: Erosion hazard | Equipment limitation | Seedling mortality | Windthrow hazard | Potential productivity: Common trees | Site index | Trees to plant |
|---|---|---|---|---|---|---|---|---|
| Mx Millgrove | 5w | Slight | Severe | Severe | Severe | Pin oak | 86 | Swamp white oak, eastern cottonwood, green ash, pin oak, red maple, silver maple, American sycamore. |
| | | | | | | Northern red oak | 80 | |
| | | | | | | Swamp white oak | 85 | |
| | | | | | | Red maple | --- | |
| | | | | | | Eastern cottonwood | --- | |
| | | | | | | Black cherry | --- | |
| | | | | | | Green ash | --- | |
| Sg Shoals | 5w | Slight | Moderate | Moderate | Slight | Pin oak | 90 | Red maple, swamp chestnut oak, pin oak, yellow-poplar. |
| | | | | | | Yellow-poplar | 90 | |
| | | | | | | Virginia pine | 90 | |
| | | | | | | Eastern cottonwood | --- | |
| | | | | | | White ash | --- | |
| Sk Sleeth | 5a | Slight | Slight | Slight | Slight | Pin oak | 85 | Eastern white pine, white ash, red maple, yellow-poplar, American sycamore. |
| | | | | | | Yellow-poplar | 85 | |
| | | | | | | White oak | 70 | |
| Sn Sloan | 5w | Slight | Severe | Severe | Severe | Pin oak | 86 | Red maple, green ash, eastern cottonwood, pin oak, swamp white oak, silver maple, American sycamore. |
| | | | | | | Swamp white oak | --- | |
| | | | | | | Red maple | --- | |
| | | | | | | Green ash | --- | |
| | | | | | | Eastern cottonwood | --- | |
| Ts Treaty | 5w | Slight | Severe | Severe | Severe | Pin oak | 90 | Eastern white pine, red maple, white ash. |
| | | | | | | White oak | 75 | |
| | | | | | | Northern red oak | --- | |
| Wb Washtenaw | 5w | Slight | Severe | Severe | Moderate | Pin oak | 86 | Eastern white pine, red maple, white ash. |
| | | | | | | Northern red oak | 75 | |
| | | | | | | Red maple | 70 | |
| | | | | | | Silver maple | --- | |
| | | | | | | White ash | --- | |
| | | | | | | American basswood | --- | |
| | | | | | | White oak | --- | |
| We Westland | 5w | Slight | Severe | Severe | Severe | Pin oak | 86 | Eastern white pine, red maple, white ash. |
| | | | | | | White oak | 75 | |

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

| Soil name and map symbol | Trees having predicted 20-year average height, in feet, of-- | | | | |
|---|---|---|---|---|---|
| | <8 | 8-15 | 16-25 | 26-35 | >35 |
| CeB2, CfB2 Celina | --- | Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush. | Northern white-cedar, white fir, blue spruce, Washington hawthorn, Austrian pine. | Norway spruce | Pin oak, eastern white pine. |
| CrA Crosby | --- | Arrowwood, eastern redcedar, Washington hawthorn, Amur honeysuckle, American cranberrybush, Amur privet, Tatarian honeysuckle. | Austrian pine, green ash, osageorange. | Eastern white pine, pin oak. | --- |
| CsA Crosby | --- | Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood. | Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn. | Norway spruce | Pin oak, eastern white pine. |
| Cy Cyclone | --- | Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush. | Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn. | Eastern white pine | Pin oak. |
| EdA, EdB2, EdC2, EdD2, EdE2, ExC3, ExD3 Eldean | Siberian peashrub | Autumn-olive, eastern redcedar, radiant crabapple, Tatarian honeysuckle, Washington hawthorn, Amur honeysuckle, lilac. | Austrian pine, eastern white pine, jack pine, red pine. | --- | --- |
| Ge Genesee | --- | Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood. | Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn. | Norway spruce | Eastern white pine, pin oak. |
| La Landes | --- | Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush. | Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn. | Norway spruce | Eastern white pine, pin oak. |

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

| Soil name and map symbol | Trees having predicted 20-year average height, in feet, of-- | | | | |
|---|---|---|---|---|---|
| | <8 | 8-15 | 16-25 | 26-35 | >35 |
| LeB2, LeC2, LeD2, LeE2, LhC3, LhD3, LsB2, LsC2, LsD2, LsE2, LxC3, LxD3- Losantville | --- | Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood. | Washington hawthorn, white fir, blue spruce, northern white-cedar. | Norway spruce, Austrian pine. | Eastern white pine, pin oak. |
| Ma. Martisco | | | | | |
| MlA, MlB2--------- Miami | --- | Amur privet, silky dogwood, American cranberrybush, Amur honeysuckle. | Northern white-cedar, Washington hawthorn, blue spruce, Austrian pine, white fir. | Norway spruce----- | Eastern white pine, pin oak. |
| MmB2, MoB2-------- Miamian | --- | American cranberrybush, Amur honeysuckle, Amur privet, silky dogwood. | Blue spruce, white fir, northern white-cedar, Washington hawthorn. | Norway spruce, Austrian pine. | Pin oak, eastern white pine. |
| Mx--------------- Millgrove | --- | Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet. | Washington hawthorn, white fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce. | Eastern white pine | Pin oak. |
| Ot*: Orthents. | | | | | |
| Aquents. | | | | | |
| Pt*. Pits | | | | | |
| Sg--------------- Shoals | --- | Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush. | Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn. | Norway spruce----- | Eastern white pine, pin oak. |
| Sk--------------- Sleeth | --- | Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood. | Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn. | Norway spruce----- | Eastern white pine, pin oak. |
| Sn--------------- Sloan | --- | Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush. | Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn. | Eastern white pine | Pin oak. |

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

| Soil name and map symbol | Trees having predicted 20-year average height, in feet, of-- | | | | |
|---|---|---|---|---|---|
| | <8 | 8-15 | 16-25 | 26-35 | >35 |
| Ts: Treaty | --- | Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood. | Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn. | Eastern white pine | Pin oak. |
| Wb: Washtenaw | --- | Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush. | Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn. | Eastern white pine | Pin oak. |
| We: Westland | --- | Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush. | Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn. | Eastern white pine | Pin oak. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails | Golf fairways |
|---|---|---|---|---|---|
| CeB2, CfB2: Celina | Moderate: wetness, percs slowly. | Moderate: wetness, percs slowly. | Moderate: slope, wetness, percs slowly. | Moderate: wetness. | Slight. |
| CrA, CsA: Crosby | Severe: wetness. | Moderate: wetness, percs slowly. | Severe: wetness. | Moderate: wetness. | Moderate: wetness. |
| Cy: Cyclone | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. |
| EdA: Eldean | Moderate: percs slowly. | Moderate: percs slowly. | Moderate: small stones. | Severe: erodes easily. | Moderate: droughty. |
| EdB2: Eldean | Moderate: percs slowly. | Moderate: percs slowly. | Moderate: slope, small stones. | Severe: erodes easily. | Moderate: droughty. |
| EdC2: Eldean | Moderate: percs slowly, slope. | Moderate: percs slowly, slope. | Severe: slope. | Severe: erodes easily. | Moderate: droughty, slope. |
| EdD2: Eldean | Severe: slope. | Severe: slope. | Severe: slope. | Severe: erodes easily. | Severe: slope. |
| EdE2: Eldean | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope, erodes easily. | Severe: slope. |
| ExC3: Eldean | Moderate: percs slowly, slope. | Moderate: percs slowly, slope. | Severe: slope. | Severe: erodes easily. | Moderate: droughty, slope. |
| ExD3: Eldean | Severe: slope. | Severe: slope. | Severe: slope. | Severe: erodes easily. | Severe: slope. |
| Ge: Genesee | Severe: flooding. | Slight | Moderate: flooding. | Slight | Moderate: flooding. |
| La: Landes | Severe: flooding. | Slight | Slight | Slight | Moderate: droughty. |
| LeB2: Losantville | Moderate: percs slowly. | Moderate: percs slowly. | Moderate: slope, percs slowly. | Slight | Moderate: droughty. |
| LeC2: Losantville | Moderate: slope, percs slowly. | Moderate: slope, percs slowly. | Severe: slope. | Severe: erodes easily. | Moderate: droughty, slope. |
| LeD2, LeE2: Losantville | Severe: slope. | Severe: slope. | Severe: slope. | Severe: erodes easily. | Severe: slope. |
| LhC3: Losantville | Moderate: slope, percs slowly. | Moderate: slope, percs slowly. | Severe: slope. | Severe: erodes easily. | Moderate: droughty, slope. |
| LhD3: Losantville | Severe: slope. | Severe: slope. | Severe: slope. | Severe: erodes easily. | Severe: slope. |

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails | Golf fairways |
|---|---|---|---|---|---|
| LsB2: Losantville | Moderate: percs slowly. | Moderate: percs slowly. | Moderate: slope, percs slowly. | Slight | Moderate: droughty. |
| LsC2: Losantville | Moderate: slope, percs slowly. | Moderate: slope, percs slowly. | Severe: slope. | Severe: erodes easily. | Moderate: droughty, slope. |
| LsD2, LsE2: Losantville | Severe: slope. | Severe: slope. | Severe: slope. | Severe: erodes easily. | Severe: slope. |
| LxC3: Losantville | Moderate: slope, percs slowly. | Moderate: slope, percs slowly. | Severe: slope. | Severe: erodes easily. | Moderate: droughty, slope. |
| LxD3: Losantville | Severe: slope. | Severe: slope. | Severe: slope. | Severe: erodes easily. | Severe: slope. |
| Ma: Martisco | Severe: flooding, ponding, excess humus. | Severe: ponding, excess humus. | Severe: ponding, flooding, excess humus. | Severe: ponding, excess humus. | Severe: ponding, flooding, excess humus. |
| MlA: Miami | Slight | Slight | Slight | Slight | Slight. |
| MlB2: Miami | Slight | Slight | Moderate: slope. | Slight | Slight. |
| MmB2, MoB2: Miamian | Moderate: percs slowly. | Moderate: percs slowly. | Moderate: percs slowly, slope. | Slight | Slight. |
| Mx: Millgrove | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. |
| Ot*: | | | | | |
| Orthents. | | | | | |
| Aquents. | | | | | |
| Pt*. Pits | | | | | |
| Sg: Shoals | Severe: flooding, wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. |
| Sk: Sleeth | Severe: wetness. | Moderate: wetness. | Severe: wetness. | Moderate: wetness. | Moderate: wetness. |
| Sn: Sloan | Severe: flooding, wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. |
| Ts: Treaty | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. |
| Wb: Washtenaw | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. |
| We: Westland | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

| Soil name and map symbol | Potential for habitat elements | | | | | | | Potential as habitat for-- | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous plants | Hardwood trees | Coniferous plants | Wetland plants | Shallow water areas | Openland wildlife | Woodland wildlife | Wetland wildlife |
| CeB2, CfB2 Celina | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| CrA, CsA Crosby | Good | Good | Good | Good | Good | Fair | Fair | Good | Good | Fair. |
| Cy Cyclone | Fair | Fair | Fair | Fair | Fair | Good | Good | Fair | Fair | Good. |
| EdA Eldean | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| EdB2 Eldean | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| EdC2 Eldean | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| EdD2 Eldean | Poor | Fair | Good | Good | Good | Very poor. | Very poor. | Fair | Good | Very poor. |
| EdE2 Eldean | Poor | Fair | Good | Good | Good | Very poor. | Very poor. | Fair | Good | Very poor. |
| ExC3 Eldean | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| ExD3 Eldean | Poor | Fair | Good | Good | Good | Very poor. | Very poor. | Fair | Good | Very poor. |
| Ge Genesee | Good | Good | Good | Good | Good | Poor | Poor | Good | Good | Poor. |
| La Landes | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| LeB2 Losantville | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| LeC2 Losantville | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| LeD2, LeE2 Losantville | Poor | Fair | Good | Good | Good | Very poor. | Very poor. | Fair | Good | Very poor. |
| LhC3 Losantville | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| LhD3 Losantville | Poor | Fair | Good | Good | Good | Very poor. | Very poor. | Fair | Good | Very poor. |
| LsB2 Losantville | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| LsC2 Losantville | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |

TABLE 11.--WILDLIFE HABITAT--Continued

| Soil name and map symbol | Potential for habitat elements | | | | | | | Potential as habitat for-- | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous plants | Hardwood trees | Coniferous plants | Wetland plants | Shallow water areas | Openland wildlife | Woodland wildlife | Wetland wildlife |
| LsD2, LsE2---------Losantville | Poor | Fair | Good | Good | Good | Very poor. | Very poor. | Fair | Good | Very poor. |
| LxC3---------------Losantville | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| LxD3---------------Losantville | Poor | Fair | Good | Good | Good | Very poor. | Very poor. | Fair | Good | Very poor. |
| Ma-----------------Martisco | Very poor. | Poor | Very poor. | Very poor. | Very poor. | Good | Good | Very poor. | Very poor. | Good. |
| MlA, MlB2----------Miami | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| MmB2, MoB2---------Miamian | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| Mx-----------------Millgrove | Fair | Fair | Poor | Poor | Poor | Good | Good | Poor | Poor | Good. |
| Ot*: | | | | | | | | | | |
| Orthents. | | | | | | | | | | |
| Aquents. | | | | | | | | | | |
| Pt*. Pits | | | | | | | | | | |
| Sg-----------------Shoals | Poor | Fair | Fair | Good | Good | Fair | Fair | Fair | Good | Fair. |
| Sk-----------------Sleeth | Fair | Good | Good | Good | Good | Fair | Fair | Good | Good | Fair. |
| Sn-----------------Sloan | Fair | Fair | Good | Poor | Poor | Good | Good | Fair | Poor | Good. |
| Ts-----------------Treaty | Fair | Poor | Poor | Poor | Poor | Good | Good | Poor | Poor | Good. |
| Wb-----------------Washtenaw | Fair | Poor | Poor | Poor | Poor | Good | Good | Poor | Poor | Good. |
| We-----------------Westland | Fair | Poor | Poor | Poor | Poor | Good | Good | Poor | Poor | Good. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| CeB2, CfB2 Celina | Severe: wetness. | Moderate: wetness, shrink-swell. | Severe: wetness. | Moderate: wetness, shrink-swell, slope. | Severe: low strength, frost action. | Slight. |
| CrA Crosby | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: low strength, frost action. | Moderate: wetness. |
| CsA Crosby | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: frost action. | Moderate: wetness. |
| Cy Cyclone | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: low strength, ponding, frost action. | Severe: ponding. |
| EdA Eldean | Severe: cutbanks cave. | Moderate: shrink-swell. | Slight | Moderate: shrink-swell. | Severe: low strength. | Moderate: droughty. |
| EdB2 Eldean | Severe: cutbanks cave. | Moderate: shrink-swell. | Slight | Moderate: shrink-swell, slope. | Severe: low strength. | Moderate: droughty. |
| EdC2 Eldean | Severe: cutbanks cave. | Moderate: shrink-swell, slope. | Moderate: slope. | Severe: slope. | Severe: low strength. | Moderate: droughty, slope. |
| EdD2, EdE2 Eldean | Severe: cutbanks cave, slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: low strength, slope. | Severe: slope. |
| ExC3 Eldean | Severe: cutbanks cave. | Moderate: shrink-swell, slope. | Moderate: slope. | Severe: slope. | Severe: low strength. | Moderate: droughty, slope. |
| ExD3 Eldean | Severe: cutbanks cave, slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: low strength, slope. | Severe: slope. |
| Ge Genesee | Moderate: flooding. | Severe: flooding. | Severe: flooding. | Severe: flooding. | Severe: flooding. | Moderate: flooding. |
| La Landes | Severe: cutbanks cave. | Severe: flooding. | Severe: flooding. | Severe: flooding. | Moderate: flooding, frost action. | Moderate: droughty. |
| LeB2 Losantville | Moderate: wetness. | Slight | Moderate: wetness. | Moderate: slope. | Moderate: frost action. | Moderate: droughty. |
| LeC2 Losantville | Moderate: wetness, slope. | Moderate: slope. | Moderate: wetness, slope. | Severe: slope. | Moderate: slope, frost action. | Moderate: droughty, slope. |
| LeD2, LeE2 Losantville | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| LhC3 Losantville | Moderate: wetness, slope. | Moderate: slope. | Moderate: wetness, slope. | Severe: slope. | Moderate: slope, frost action. | Moderate: droughty, slope. |

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| LhD3: Losantville | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| LsB2: Losantville | Moderate: wetness. | Slight | Moderate: wetness. | Moderate: slope. | Moderate: frost action. | Moderate: droughty. |
| LsC2: Losantville | Moderate: wetness, slope. | Moderate: slope. | Moderate: wetness, slope. | Severe: slope. | Moderate: slope, frost action. | Moderate: droughty, slope. |
| LsD2, LsE2: Losantville | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| LxC3: Losantville | Moderate: wetness, slope. | Moderate: slope. | Moderate: wetness, slope. | Severe: slope. | Moderate: slope, frost action. | Moderate: droughty, slope. |
| LxD3: Losantville | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| Ma: Martisco | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding, frost action, low strength. | Severe: ponding, excess humus. |
| MlA: Miami | Slight | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell. | Severe: low strength. | Slight. |
| MlB2: Miami | Slight | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell, slope. | Severe: low strength. | Slight. |
| MmB2, MoB2: Miamian | Moderate: too clayey, dense layer. | Moderate: shrink-swell. | Slight | Moderate: slope, shrink-swell. | Moderate: frost action. | Slight. |
| Mx: Millgrove | Severe: cutbanks cave, ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding, frost action. | Severe: ponding. |
| Ot*: Orthents. | | | | | | |
| Aquents. | | | | | | |
| Pt*. Pits | | | | | | |
| Sg: Shoals | Severe: wetness. | Severe: flooding, wetness. | Severe: flooding, wetness. | Severe: flooding, wetness. | Severe: wetness, flooding, frost action. | Severe: wetness. |
| Sk: Sleeth | Severe: cutbanks cave, wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: low strength, frost action. | Moderate: wetness. |
| Sn: Sloan | Severe: wetness. | Severe: flooding, wetness. | Severe: flooding, wetness. | Severe: flooding, wetness. | Severe: low strength, wetness, flooding. | Severe: wetness. |

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| Ts---------------- Treaty | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: low strength, ponding, frost action. | Severe: ponding. |
| Wb---------------- Washtenaw | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding, frost action. | Severe: ponding. |
| We---------------- Westland | Severe: cutbanks cave, ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: low strength, ponding, frost action. | Severe: ponding. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| CeB2, CfB2: Celina | Severe: wetness, percs slowly. | Moderate: slope. | Moderate: wetness, too clayey. | Moderate: wetness. | Fair: too clayey. |
| CrA, CsA: Crosby | Severe: wetness, percs slowly. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Poor: wetness. |
| Cy: Cyclone | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Poor: ponding. |
| EdA, EdB2: Eldean | Severe: poor filter. | Severe: seepage. | Severe: seepage, too sandy. | Severe: seepage. | Poor: seepage, too sandy, small stones. |
| EdC2: Eldean | Severe: poor filter. | Severe: seepage, slope. | Severe: seepage, too sandy. | Severe: seepage. | Poor: seepage, too sandy, small stones. |
| EdD2, EdE2: Eldean | Severe: poor filter, slope. | Severe: seepage, slope. | Severe: seepage, slope, too sandy. | Severe: seepage, slope. | Poor: seepage, too sandy, small stones. |
| ExC3: Eldean | Severe: poor filter. | Severe: seepage, slope. | Severe: seepage, too sandy. | Severe: seepage. | Poor: seepage, too sandy, small stones. |
| ExD3: Eldean | Severe: poor filter, slope. | Severe: seepage, slope. | Severe: seepage, slope, too sandy. | Severe: seepage, slope. | Poor: seepage, too sandy, small stones. |
| Ge: Genesee | Severe: flooding. | Severe: flooding. | Severe: flooding. | Severe: flooding. | Good. |
| La: Landes | Severe: poor filter. | Severe: seepage. | Severe: seepage, too sandy. | Severe: seepage. | Poor: seepage, too sandy. |
| LeB2: Losantville | Severe: percs slowly. | Moderate: seepage, slope, wetness. | Slight | Slight | Good. |
| LeC2: Losantville | Severe: percs slowly. | Severe: slope. | Moderate: slope. | Moderate: slope. | Fair: slope. |
| LeD2, LeE2: Losantville | Severe: percs slowly, slope. | Severe: slope. | Severe: slope. | Severe: slope. | Poor: slope. |
| LhC3: Losantville | Severe: percs slowly. | Severe: slope. | Moderate: slope. | Moderate: slope. | Fair: slope. |

TABLE 13.--SANITARY FACILITIES--Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| LhD3: Losantville | Severe: percs slowly, slope. | Severe: slope. | Severe: slope. | Severe: slope. | Poor: slope. |
| LsB2: Losantville | Severe: percs slowly. | Moderate: seepage, slope, wetness. | Slight | Slight | Good. |
| LsC2: Losantville | Severe: percs slowly. | Severe: slope. | Moderate: slope. | Moderate: slope. | Fair: slope. |
| LsD2, LsE2: Losantville | Severe: percs slowly, slope. | Severe: slope. | Severe: slope. | Severe: slope. | Poor: slope. |
| LxC3: Losantville | Severe: percs slowly. | Severe: slope. | Moderate: slope. | Moderate: slope. | Fair: slope. |
| LxD3: Losantville | Severe: percs slowly, slope. | Severe: slope. | Severe: slope. | Severe: slope. | Poor: slope. |
| Ma: Martisco | Severe: ponding, percs slowly. | Severe: seepage, excess humus. | Severe: ponding, seepage. | Severe: seepage, ponding. | Poor: ponding, excess humus. |
| MlA, MlB2: Miami | Moderate: percs slowly. | Moderate: seepage. | Severe: seepage. | Slight | Fair: too clayey, thin layer. |
| MmB2, MoB2: Miamian | Severe: percs slowly. | Moderate: slope. | Slight | Slight | Fair: small stones. |
| Mx: Millgrove | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Poor: small stones, ponding. |
| Ot*: | | | | | |
| Orthents. | | | | | |
| Aquents. | | | | | |
| Pt*. Pits | | | | | |
| Sg: Shoals | Severe: flooding, wetness. | Severe: flooding, wetness. | Severe: flooding, wetness. | Severe: flooding, wetness. | Poor: wetness. |
| Sk: Sleeth | Severe: wetness. | Severe: seepage, wetness. | Severe: seepage, wetness. | Severe: wetness. | Poor: wetness. |
| Sn: Sloan | Severe: flooding, wetness, percs slowly. | Severe: flooding, wetness. | Severe: flooding, wetness. | Severe: flooding, wetness. | Poor: wetness. |
| Ts: Treaty | Severe: ponding, percs slowly. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Poor: ponding. |

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| Wb------------------ Washtenaw | Severe: ponding, percs slowly. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Poor: ponding. |
| We------------------ Westland | Severe: ponding. | Severe: seepage, ponding. | Severe: seepage, ponding. | Severe: ponding. | Poor: ponding. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| CeB2, CfB2: Celina | Fair: wetness. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer. |
| CrA: Crosby | Fair: wetness. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer. |
| CsA: Crosby | Fair: wetness. | Improbable: excess fines. | Improbable: excess fines. | Fair: small stones, area reclaim. |
| Cy: Cyclone | Poor: wetness. | Improbable: excess fines. | Improbable: excess fines. | Poor: wetness. |
| EdA, EdB2, EdC2: Eldean | Good | Probable | Probable | Poor: small stones, area reclaim. |
| EdD2: Eldean | Fair: slope. | Probable | Probable | Poor: small stones, area reclaim, slope. |
| EdE2: Eldean | Poor: slope. | Probable | Probable | Poor: small stones, area reclaim, slope. |
| ExC3: Eldean | Good | Probable | Probable | Poor: small stones, area reclaim. |
| ExD3: Eldean | Fair: slope. | Probable | Probable | Poor: small stones, area reclaim, slope. |
| Ge: Genesee | Good | Improbable: excess fines. | Improbable: excess fines. | Good. |
| La: Landes | Good | Probable | Improbable: too sandy. | Fair: thin layer. |
| LeB2, LeC2: Losantville | Good | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer. |
| LeD2: Losantville | Fair: slope. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer, slope. |
| LeE2: Losantville | Poor: slope. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer, slope. |
| LhC3: Losantville | Good | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer. |
| LhD3: Losantville | Fair: slope. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer, slope. |

TABLE 14.--CONSTRUCTION MATERIALS--Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| LsB2, LsC2: Losantville | Good | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer. |
| LsD2: Losantville | Fair: slope. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer, slope. |
| LsE2: Losantville | Poor: slope. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer, slope. |
| LxC3: Losantville | Good | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer. |
| LxD3: Losantville | Fair: slope. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer, slope. |
| Ma: Martisco | Poor: ponding, low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: wetness, excess humus. |
| MlA, MlB2: Miami | Good | Probable | Probable | Fair: small stones, area reclaim. |
| MmB2, MoB2: Miamian | Good | Improbable: excess fines. | Improbable: excess fines. | Fair: small stones. |
| Mx: Millgrove | Poor: wetness. | Improbable: excess fines. | Improbable: excess fines. | Poor: area reclaim, wetness. |
| Ot*: | | | | |
| Orthents. | | | | |
| Aquents. | | | | |
| Pt*. Pits | | | | |
| Sg: Shoals | Poor: wetness. | Improbable: excess fines. | Improbable: excess fines. | Good. |
| Sk: Sleeth | Fair: wetness. | Probable | Probable | Poor: area reclaim. |
| Sn: Sloan | Poor: wetness, low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: wetness. |
| Ts: Treaty | Poor: wetness. | Improbable: excess fines. | Improbable: excess fines. | Poor: wetness. |
| Wb: Washtenaw | Poor: wetness. | Improbable: excess fines. | Improbable: excess fines. | Poor: wetness. |
| We: Westland | Poor: wetness. | Probable | Probable | Poor: wetness, small stones, area reclaim. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

| Soil name and map symbol | Limitations for-- | | Features affecting-- | | | |
|---|---|---|---|---|---|---|
| | Pond reservoir areas | Aquifer-fed excavated ponds | Drainage | Irrigation | Terraces and diversions | Grassed waterways |
| CeB2, CfB2: Celina | Moderate: slope. | Severe: no water. | Frost action, slope. | Wetness, slope, erodes easily. | Erodes easily, wetness. | Erodes easily. |
| CrA: Crosby | Slight | Severe: no water. | Percs slowly, frost action. | Wetness, percs slowly, rooting depth. | Erodes easily, wetness. | Wetness, erodes easily, rooting depth. |
| CsA: Crosby | Slight | Severe: no water. | Percs slowly, frost action. | Wetness, percs slowly, rooting depth. | Erodes easily, wetness, percs slowly. | Wetness, erodes easily, rooting depth. |
| Cy: Cyclone | Moderate: seepage. | Severe: slow refill. | Ponding, frost action. | Ponding | Ponding | Wetness. |
| EdA: Eldean | Severe: seepage. | Severe: no water. | Deep to water | Droughty, erodes easily. | Erodes easily, too sandy. | Erodes easily, droughty. |
| EdB2: Eldean | Severe: seepage. | Severe: no water. | Deep to water | Droughty, slope, erodes easily. | Erodes easily, too sandy. | Erodes easily, droughty. |
| EdC2, EdD2, EdE2, ExC3, ExD3: Eldean | Severe: seepage, slope. | Severe: no water. | Deep to water | Droughty, slope, erodes easily. | Slope, erodes easily, too sandy. | Slope, erodes easily, droughty. |
| Ge: Genesee | Moderate: seepage. | Severe: no water. | Deep to water | Flooding, erodes easily. | Erodes easily | Erodes easily. |
| La: Landes | Severe: seepage. | Severe: no water. | Deep to water | Droughty, soil blowing, fast intake. | Too sandy | Favorable. |
| LeB2: Losantville | Moderate: slope. | Severe: no water. | Deep to water | Droughty, percs slowly, rooting depth. | Erodes easily, percs slowly. | Erodes easily, droughty. |
| LeC2, LeD2, LeE2, LhC3, LhD3: Losantville | Severe: slope. | Severe: no water. | Deep to water | Droughty, percs slowly, rooting depth. | Slope, erodes easily, percs slowly. | Slope, erodes easily, droughty. |
| LsB2: Losantville | Moderate: slope. | Severe: no water. | Deep to water | Droughty, percs slowly, rooting depth. | Erodes easily, percs slowly. | Erodes easily, droughty. |
| LsC2, LsD2, LsE2, LxC3, LxD3: Losantville | Severe: slope. | Severe: no water. | Deep to water | Droughty, percs slowly, rooting depth. | Slope, erodes easily, percs slowly. | Slope, erodes easily, droughty. |
| Ma: Martisco | Severe: seepage. | Severe: slow refill. | Percs slowly, ponding. | Ponding, soil blowing. | Ponding, soil blowing, percs slowly. | Wetness, percs slowly. |
| MlA: Miami | Moderate: seepage. | Severe: no water. | Deep to water | Erodes easily | Erodes easily | Erodes easily. |

TABLE 15.--WATER MANAGEMENT--Continued

| Soil name and map symbol | Limitations for-- | | Features affecting-- | | | |
|---|---|---|---|---|---|---|
| | Pond reservoir areas | Aquifer-fed excavated ponds | Drainage | Irrigation | Terraces and diversions | Grassed waterways |
| MlB2-------------- Miami | Moderate: seepage, slope. | Severe: no water. | Deep to water | Slope, erodes easily. | Erodes easily | Erodes easily. |
| MmB2, MoB2-------- Miamian | Moderate: slope. | Severe: no water. | Deep to water | Rooting depth, slope, erodes easily. | Erodes easily | Erodes easily, rooting depth. |
| Mx---------------- Millgrove | Moderate: seepage. | Moderate: slow refill. | Ponding, frost action. | Ponding-------- | Ponding-------- | Wetness. |
| Ot*: Orthents. | | | | | | |
| Aquents. | | | | | | |
| Pt*. Pits | | | | | | |
| Sg---------------- Shoals | Moderate: seepage. | Moderate: slow refill. | Flooding, frost action. | Wetness, erodes easily, flooding. | Erodes easily, wetness. | Wetness, erodes easily. |
| Sk---------------- Sleeth | Severe: seepage. | Severe: cutbanks cave. | Frost action--- | Wetness-------- | Wetness-------- | Wetness. |
| Sn---------------- Sloan | Moderate: seepage. | Severe: slow refill. | Flooding, frost action. | Wetness, erodes easily, flooding. | Erodes easily, wetness. | Wetness, erodes easily. |
| Ts---------------- Treaty | Moderate: seepage. | Severe: slow refill. | Ponding, frost action. | Ponding-------- | Ponding, erodes easily. | Wetness, erodes easily. |
| Wb---------------- Washtenaw | Moderate: seepage. | Severe: slow refill. | Ponding, percs slowly, frost action. | Ponding, percs slowly, erodes easily. | Erodes easily, ponding. | Wetness, erodes easily, percs slowly. |
| We---------------- Westland | Severe: seepage. | Severe: cutbanks cave. | Ponding, frost action. | Ponding-------- | Ponding-------- | Wetness. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

| Soil name and map symbol | Depth | USDA texture | Classification: Unified | Classification: AASHTO | Frag- ments > 3 inches | Percentage passing sieve number--: 4 | 10 | 40 | 200 | Liquid limit | Plas- ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | | | | Pct | | | | | Pct | |
| CeB2-------------- Celina | 0-9 | Silt loam-------- | ML | A-4 | 0 | 100 | 90-100 | 90-100 | 70-85 | 26-40 | 3-10 |
| | 9-32 | Clay, clay loam, silty clay loam. | CL | A-6, A-7 | 0 | 100 | 90-100 | 80-95 | 70-85 | 32-48 | 12-28 |
| | 32-60 | Loam, silt loam | CL, CL-ML | A-4, A-6 | 0 | 75-95 | 75-90 | 65-90 | 50-80 | 20-36 | 4-16 |
| CfB2-------------- Celina | 0-7 | Silt loam-------- | ML | A-4 | 0 | 100 | 90-100 | 90-100 | 70-85 | 26-40 | 3-10 |
| | 7-34 | Clay, clay loam, silty clay loam. | CL | A-6, A-7 | 0 | 100 | 90-100 | 80-95 | 70-85 | 32-48 | 12-28 |
| | 34-60 | Loam, silt loam | CL, CL-ML | A-4, A-6 | 0 | 75-95 | 75-90 | 65-90 | 50-80 | 20-36 | 4-16 |
| CrA--------------- Crosby | 0-11 | Silt loam-------- | CL, CL-ML, ML | A-4, A-6 | 0 | 100 | 95-100 | 80-100 | 50-90 | 15-30 | 4-15 |
| | 11-28 | Clay loam, silty clay loam, clay. | CL | A-6, A-7 | 0-3 | 90-100 | 85-100 | 75-95 | 65-95 | 35-50 | 15-25 |
| | 28-60 | Loam------------- | CL, ML, CL-ML | A-4, A-6 | 0-3 | 85-100 | 80-95 | 75-90 | 50-65 | 15-30 | 4-15 |
| CsA--------------- Crosby | 0-9 | Silt loam-------- | CL-ML, CL | A-4, A-6 | 0 | 100 | 95-100 | 85-100 | 65-90 | 20-35 | 5-15 |
| | 9-26 | Silty clay loam, clay loam. | CL | A-6, A-7 | 0 | 100 | 95-100 | 90-100 | 80-95 | 35-45 | 15-20 |
| | 26-60 | Loam------------- | CL-ML, CL | A-4, A-6 | 0-10 | 85-95 | 80-90 | 65-90 | 50-70 | 20-35 | 5-15 |
| Cy---------------- Cyclone | 0-12 | Silty clay loam | CL | A-6, A-7 | 0 | 100 | 100 | 95-100 | 85-95 | 30-45 | 12-25 |
| | 12-46 | Silty clay loam | CL | A-6, A-7 | 0 | 100 | 100 | 95-100 | 85-95 | 30-50 | 15-30 |
| | 46-60 | Loam, clay loam | CL, CL-ML | A-4, A-6 | 0 | 95-100 | 85-100 | 80-95 | 50-80 | 25-40 | 4-15 |
| | 60-80 | Loam------------- | CL-ML, CL | A-4, A-6 | 0 | 90-100 | 85-100 | 75-95 | 50-75 | 20-30 | 6-15 |
| EdA, EdB2, EdC2, EdD2, EdE2------ Eldean | 0-10 | Silt loam-------- | ML, CL-ML, CL | A-4, A-6 | 0 | 85-100 | 80-100 | 70-100 | 55-90 | 20-40 | 4-14 |
| | 10-26 | Clay, sandy clay, gravelly clay loam. | CL, ML | A-7, A-6 | 0-5 | 75-100 | 60-100 | 55-95 | 50-80 | 38-50 | 12-23 |
| | 26-31 | Gravelly clay loam, loam, gravelly sandy loam. | CL, GC, SC | A-4, A-6, A-7, A-2 | 0-10 | 55-85 | 45-85 | 45-75 | 30-60 | 30-45 | 8-20 |
| | 31-60 | Stratified sand to gravel. | GM, SM, GP-GM, SP-SM | A-1, A-2 | 0-15 | 30-70 | 20-50 | 5-40 | 0-35 | --- | NP |
| ExC3, ExD3-------- Eldean | 0-5 | Clay loam-------- | CL | A-6, A-4 | 0-5 | 85-100 | 75-100 | 65-100 | 55-80 | 25-40 | 9-18 |
| | 5-32 | Clay, sandy clay, gravelly clay loam. | CL, ML | A-7, A-6 | 0-5 | 75-100 | 60-100 | 55-95 | 50-80 | 38-50 | 12-23 |
| | 32-60 | Stratified sand to gravel. | GM, SM, GP-GM, SP-SM | A-1, A-2 | 0-15 | 30-70 | 20-50 | 5-40 | 0-35 | --- | NP |
| Ge---------------- Genesee | 0-17 | Loam------------- | ML, CL | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-90 | 26-40 | 3-15 |
| | 17-37 | Silt loam, loam | ML, CL | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-90 | 26-40 | 3-15 |
| | 37-60 | Stratified sandy loam to silt loam. | ML, CL, CL-ML | A-4, A-6 | 0 | 90-100 | 85-100 | 60-90 | 50-90 | 20-35 | 3-15 |
| La---------------- Landes | 0-23 | Loam------------- | CL, CL-ML | A-4, A-6 | 0 | 100 | 90-100 | 85-95 | 50-75 | 20-35 | 5-15 |
| | 23-60 | Stratified sand to silt loam. | SM, SP-SM, SC, SM-SC | A-2, A-4 | 0 | 100 | 85-100 | 70-95 | 10-50 | <30 | NP-10 |
| LeB2, LeC2, LeD2, LeE2------------ Losantville | 0-7 | Silt loam-------- | CL, CL-ML | A-4, A-6 | 0-2 | 95-100 | 90-100 | 80-100 | 65-90 | 20-30 | 5-12 |
| | 7-16 | Clay, clay loam | CL | A-7, A-6 | 0-2 | 90-100 | 85-100 | 75-95 | 60-90 | 35-50 | 15-25 |
| | 16-60 | Loam------------- | CL, CL-ML | A-4 | 0-5 | 85-95 | 80-95 | 65-85 | 50-70 | 20-30 | 5-10 |

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Fragments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| LhC3, LhD3: Losantville | 0-4 | Clay loam | CL | A-6 | 0-2 | 95-100 | 90-100 | 80-100 | 65-80 | 30-40 | 11-20 |
| | 4-13 | Clay, clay loam | CL | A-7, A-6 | 0-2 | 90-100 | 85-100 | 75-95 | 60-90 | 35-50 | 15-25 |
| | 13-60 | Loam | CL, CL-ML | A-4 | 0-5 | 85-95 | 80-95 | 65-85 | 50-70 | 20-30 | 5-10 |
| LsB2, LsC2, LsD2, LsE2: Losantville | 0-5 | Silt loam | CL, CL-ML | A-4, A-6 | 0-2 | 95-100 | 90-100 | 80-100 | 65-90 | 20-30 | 5-12 |
| | 5-20 | Clay, clay loam | CL | A-7, A-6 | 0-2 | 90-100 | 85-100 | 75-95 | 60-90 | 35-50 | 15-25 |
| | 20-60 | Loam | CL, CL-ML | A-4 | 0-5 | 85-95 | 80-95 | 65-85 | 50-70 | 20-30 | 5-10 |
| LxC3, LxD3: Losantville | 0-4 | Clay loam | CL | A-6 | 0-2 | 95-100 | 90-100 | 80-100 | 65-80 | 30-40 | 11-20 |
| | 4-12 | Clay, clay loam | CL | A-7, A-6 | 0-2 | 90-100 | 85-100 | 75-95 | 60-90 | 35-50 | 15-25 |
| | 12-60 | Loam | CL, CL-ML | A-4 | 0-5 | 85-95 | 80-95 | 65-85 | 50-70 | 20-30 | 5-10 |
| Ma: Martisco | 0-15 | Sapric material | PT | A-8 | 0 | --- | --- | --- | --- | --- | --- |
| | 15-27 | Marl | --- | --- | 0 | --- | --- | --- | --- | --- | --- |
| | 27-60 | Stratified gravelly sandy loam to silty clay loam. | CL, SC | A-4, A-6 | 0 | 65-100 | 40-90 | 30-80 | 20-70 | 15-25 | 4-15 |
| MlA, MlB2: Miami | 0-15 | Silt loam | CL-ML, CL | A-4, A-6 | 0 | 100 | 95-100 | 85-100 | 70-90 | 20-30 | 6-15 |
| | 15-39 | Silty clay loam, clay loam. | CL | A-6 | 0 | 100 | 90-100 | 80-100 | 65-95 | 30-40 | 10-20 |
| | 39-60 | Loam, silt loam | CL-ML, CL | A-4, A-6 | 0 | 100 | 90-100 | 75-100 | 55-85 | 20-35 | 5-15 |
| MmB2: Miamian | 0-9 | Silt loam | ML | A-4, A-6 | 0 | 95-100 | 95-100 | 90-100 | 70-95 | 26-40 | 4-12 |
| | 9-32 | Silty clay loam, clay loam, clay. | CL | A-6, A-7 | 0-5 | 85-100 | 80-100 | 75-95 | 70-85 | 32-50 | 15-30 |
| | 32-60 | Loam, silt loam | CL, ML, CL-ML | A-4, A-6 | 0-5 | 75-95 | 75-90 | 65-85 | 50-75 | 20-35 | 3-13 |
| MoB2: Miamian | 0-7 | Silt loam | ML | A-4, A-6 | 0 | 95-100 | 95-100 | 90-100 | 70-95 | 26-40 | 4-12 |
| | 7-34 | Silty clay loam, clay loam, clay. | CL | A-6, A-7 | 0-5 | 85-100 | 80-100 | 75-95 | 70-85 | 32-50 | 15-30 |
| | 34-60 | Loam, silt loam | CL, ML, CL-ML | A-4, A-6 | 0-5 | 75-95 | 75-90 | 65-85 | 50-75 | 20-35 | 3-13 |
| Mx: Millgrove | 0-12 | Loam | ML, CL, CL-ML | A-4, A-6 | 0 | 85-100 | 80-100 | 70-100 | 55-85 | 20-40 | 3-16 |
| | 12-36 | Clay loam, sandy clay loam, loam. | CL, SC | A-6 | 0 | 85-100 | 80-100 | 70-95 | 40-75 | 25-40 | 11-26 |
| | 36-60 | Gravelly loam, very gravelly sandy loam, gravelly clay loam. | CL, CL-ML, SC, SM-SC | A-4, A-6, A-2, A-1 | 0-5 | 60-100 | 35-85 | 25-80 | 15-60 | 25-40 | 4-15 |
| Ot*: Orthents. | | | | | | | | | | | |
| Aquents. | | | | | | | | | | | |
| Pt*. Pits | | | | | | | | | | | |
| Sg: Shoals | 0-8 | Loam | CL, CL-ML | A-4, A-6 | 0 | 100 | 100 | 90-100 | 65-90 | 20-35 | 6-15 |
| | 8-43 | Silt loam, loam, clay loam. | CL, CL-ML | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-85 | 25-40 | 5-15 |
| | 43-60 | Stratified silt loam to loamy sand. | ML, CL, CL-ML | A-4 | 0-3 | 90-100 | 80-100 | 50-80 | 40-70 | <30 | 4-10 |

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

| Soil name and map symbol | Depth | USDA texture | Classification: Unified | Classification: AASHTO | Frag-ments > 3 inches | Percentage passing sieve number--: 4 | 10 | 40 | 200 | Liquid limit | Plas-ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | | | | Pct | | | | | Pct | |
| Sk----------------Sleeth | 0-13 | Silt loam-------- | CL, ML, CL-ML | A-4, A-6 | 0 | 100 | 90-100 | 75-95 | 50-85 | 20-35 | 3-15 |
| | 13-42 | Clay loam, silty clay loam, sandy clay loam. | CL | A-6 | 0 | 85-95 | 85-95 | 80-90 | 65-75 | 30-40 | 15-25 |
| | 42-46 | Gravelly clay loam, gravelly sandy clay loam, gravelly loam. | CL | A-6 | 0-3 | 65-95 | 60-85 | 55-70 | 50-70 | 30-40 | 15-25 |
| | 46-60 | Stratified sand to gravelly sand. | SP, GP, SP-SM, GP-GM | A-1 | 1-5 | 30-70 | 22-55 | 7-20 | 2-10 | --- | NP |
| Sn----------------Sloan | 0-13 | Silty clay loam | CL | A-6, A-7 | 0 | 100 | 95-100 | 85-100 | 70-95 | 35-45 | 12-20 |
| | 13-32 | Silty clay loam, clay loam, silt loam. | CL, ML | A-6, A-7, A-4 | 0 | 100 | 90-100 | 85-100 | 75-95 | 30-45 | 8-18 |
| | 32-60 | Stratified gravelly sandy loam to silty clay loam. | ML, CL | A-4, A-6 | 0 | 95-100 | 70-100 | 60-95 | 50-90 | 25-40 | 3-15 |
| Ts----------------Treaty | 0-8 | Silt loam-------- | CL, CL-ML | A-4, A-6 | 0 | 100 | 100 | 95-100 | 80-95 | 25-40 | 5-15 |
| | 8-25 | Silty clay loam | CL | A-6 | 0 | 100 | 100 | 95-100 | 85-95 | 30-40 | 10-15 |
| | 25-51 | Clay loam, silty clay loam, loam. | CL, CL-ML | A-6, A-4 | 0 | 95-100 | 90-100 | 75-95 | 55-85 | 25-40 | 5-15 |
| | 51-60 | Loam, silt loam | CL-ML, CL | A-4, A-6 | 0 | 90-100 | 90-95 | 75-90 | 55-75 | 20-30 | 5-15 |
| Wb----------------Washtenaw | 0-8 | Silt loam-------- | ML, CL | A-4, A-6 | 0 | 100 | 100 | 90-100 | 70-90 | 27-36 | 4-12 |
| | 8-20 | Silt loam, loam | CL, ML | A-6, A-4 | 0 | 100 | 100 | 90-100 | 70-90 | 27-36 | 4-12 |
| | 20-50 | Silty clay loam, clay loam. | CL | A-6, A-7 | 0 | 95-100 | 95-100 | 90-100 | 75-95 | 36-50 | 15-28 |
| | 50-60 | Loam------------- | CL | A-4, A-6 | 0-3 | 90-100 | 85-95 | 80-95 | 60-75 | 22-33 | 8-15 |
| We----------------Westland | 0-10 | Silt loam-------- | CL | A-6 | 0 | 95-100 | 90-100 | 85-95 | 65-75 | 27-38 | 11-20 |
| | 10-30 | Clay loam-------- | CL | A-6, A-7 | 0 | 95-100 | 90-100 | 80-90 | 65-75 | 35-50 | 15-30 |
| | 30-45 | Gravelly clay loam, gravelly sandy loam. | CL | A-6, A-7 | 0-5 | 65-75 | 60-70 | 55-70 | 50-70 | 30-50 | 15-30 |
| | 45-60 | Stratified sand to gravelly sand. | SP, GP, SP-SM, GP-GM | A-1 | 1-5 | 30-70 | 22-55 | 7-20 | 2-10 | --- | NP |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

| Soil name and map symbol | Depth | Clay | Moist bulk density | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Erosion factors K | Erosion factors T | Wind erodibility group | Organic matter |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | Pct | g/cc | In/hr | In/in | pH | | | | | Pct |
| CeB2-------------- | 0-9 | 14-26 | 1.30-1.50 | 0.6-2.0 | 0.20-0.24 | 5.6-7.3 | Low----------- | 0.37 | 5 | 6 | 1-3 |
| Celina | 9-32 | 35-48 | 1.45-1.70 | 0.2-0.6 | 0.16-0.19 | 4.5-7.8 | Moderate----- | 0.37 | | | |
| | 32-60 | 16-27 | 1.60-1.82 | 0.2-0.6 | 0.06-0.10 | 7.4-8.4 | Low----------- | 0.37 | | | |
| CfB2-------------- | 0-7 | 14-26 | 1.30-1.50 | 0.6-2.0 | 0.20-0.24 | 5.6-7.3 | Low----------- | 0.37 | 5 | 6 | 1-3 |
| Celina | 7-34 | 35-48 | 1.45-1.70 | 0.2-0.6 | 0.16-0.19 | 4.5-7.8 | Moderate----- | 0.37 | | | |
| | 34-60 | 16-27 | 1.60-1.82 | 0.2-0.6 | 0.06-0.10 | 7.4-8.4 | Low----------- | 0.37 | | | |
| CrA--------------- | 0-11 | 11-24 | 1.35-1.45 | 0.6-2.0 | 0.20-0.24 | 5.1-7.3 | Low----------- | 0.43 | 3 | 5 | 1-3 |
| Crosby | 11-28 | 25-45 | 1.50-1.70 | 0.06-0.2 | 0.15-0.20 | 5.1-7.3 | Moderate----- | 0.43 | | | |
| | 28-60 | 15-27 | 1.70-2.00 | 0.06-0.6 | 0.05-0.17 | 7.4-8.4 | Low----------- | 0.43 | | | |
| CsA--------------- | 0-9 | 15-24 | 1.40-1.55 | 0.6-2.0 | 0.19-0.22 | 5.1-7.3 | Low----------- | 0.37 | 3 | 5 | 1-3 |
| Crosby | 9-26 | 35-40 | 1.45-1.60 | 0.06-0.2 | 0.16-0.17 | 5.1-7.3 | Moderate----- | 0.37 | | | |
| | 26-60 | 15-27 | 1.70-2.00 | 0.06-0.2 | 0.05-0.15 | 7.4-8.4 | Low----------- | 0.37 | | | |
| Cy---------------- | 0-12 | 27-33 | 1.40-1.60 | 0.6-2.0 | 0.22-0.24 | 6.1-7.3 | Low----------- | 0.28 | 5 | 7 | 4-6 |
| Cyclone | 12-46 | 27-35 | 1.40-1.60 | 0.6-2.0 | 0.18-0.20 | 6.1-7.3 | Moderate----- | 0.43 | | | |
| | 46-60 | 15-30 | 1.40-1.60 | 0.6-2.0 | 0.15-0.19 | 6.6-7.8 | Low----------- | 0.43 | | | |
| | 60-80 | 15-25 | 1.50-1.80 | 0.2-0.6 | 0.05-0.19 | 7.4-8.4 | Low----------- | 0.43 | | | |
| EdA, EdB2, EdC2, EdD2, EdE2------- | 0-10 | 15-25 | 1.30-1.50 | 0.6-2.0 | 0.18-0.22 | 5.6-7.3 | Low----------- | 0.37 | 4 | 5 | 1-3 |
| Eldean | 10-26 | 35-48 | 1.40-1.60 | 0.2-2.0 | 0.08-0.14 | 5.6-7.8 | Moderate----- | 0.37 | | | |
| | 26-31 | 25-45 | 1.30-1.60 | 0.6-2.0 | 0.07-0.14 | 6.6-8.4 | Low----------- | 0.37 | | | |
| | 31-60 | 2-8 | 1.55-1.70 | >6.0 | 0.01-0.04 | 7.4-8.4 | Low----------- | 0.10 | | | |
| ExC3, ExD3-------- | 0-5 | 27-33 | 1.35-1.55 | 0.6-2.0 | 0.16-0.18 | 5.6-7.3 | Low----------- | 0.37 | 3 | 6 | .5-3 |
| Eldean | 5-32 | 35-48 | 1.40-1.60 | 0.2-2.0 | 0.08-0.14 | 5.6-7.8 | Moderate----- | 0.37 | | | |
| | 32-60 | 2-8 | 1.55-1.70 | >6.0 | 0.01-0.04 | 7.4-8.4 | Low----------- | 0.10 | | | |
| Ge---------------- | 0-17 | 18-27 | 1.30-1.50 | 0.6-2.0 | 0.20-0.24 | 6.1-7.8 | Low----------- | 0.37 | 5 | 5 | 1-3 |
| Genesee | 17-37 | 18-27 | 1.30-1.50 | 0.6-2.0 | 0.17-0.22 | 6.1-8.4 | Low----------- | 0.37 | | | |
| | 37-60 | 10-20 | 1.30-1.50 | 0.6-2.0 | 0.19-0.21 | 7.4-8.4 | Low----------- | 0.37 | | | |
| La---------------- | 0-23 | 10-22 | 1.20-1.40 | 0.6-2.0 | 0.20-0.22 | 6.1-8.4 | Low----------- | 0.28 | 5 | 5 | 5-7 |
| Landes | 23-60 | 5-22 | 1.60-1.80 | 6.0-20 | 0.05-0.15 | 6.1-8.4 | Low----------- | 0.20 | | | |
| LeB2, LeC2, LeD2, LeE2------------- | 0-7 | 18-27 | 1.30-1.55 | 0.6-2.0 | 0.20-0.24 | 5.6-7.3 | Low----------- | 0.37 | 3 | 6 | 1-3 |
| Losantville | 7-16 | 35-45 | 1.40-1.70 | 0.2-2.0 | 0.09-0.19 | 6.1-7.8 | Moderate----- | 0.37 | | | |
| | 16-60 | 12-24 | 1.50-1.80 | 0.06-0.2 | 0.05-0.19 | 7.4-8.4 | Low----------- | 0.37 | | | |
| LhC3, LhD3-------- | 0-4 | 27-35 | 1.30-1.60 | 0.2-0.6 | 0.17-0.19 | 5.6-7.3 | Moderate----- | 0.37 | 2 | 6 | .5-3 |
| Losantville | 4-13 | 35-45 | 1.40-1.70 | 0.2-2.0 | 0.09-0.19 | 6.1-7.8 | Moderate----- | 0.37 | | | |
| | 13-60 | 12-24 | 1.50-1.80 | 0.06-0.2 | 0.05-0.19 | 7.4-8.4 | Low----------- | 0.37 | | | |
| LsB2, LsC2, LsD2, LsE2------------- | 0-5 | 18-27 | 1.30-1.55 | 0.6-2.0 | 0.20-0.24 | 5.6-7.3 | Low----------- | 0.37 | 3 | 6 | .5-3 |
| Losantville | 5-20 | 35-45 | 1.40-1.70 | 0.2-2.0 | 0.09-0.19 | 6.1-7.8 | Moderate----- | 0.37 | | | |
| | 20-60 | 12-24 | 1.50-1.80 | 0.06-0.2 | 0.05-0.19 | 7.4-8.4 | Low----------- | 0.37 | | | |
| LxC3, LxD3-------- | 0-4 | 27-35 | 1.30-1.60 | 0.2-0.6 | 0.17-0.19 | 5.6-7.3 | Moderate----- | 0.37 | 2 | 6 | .5-2 |
| Losantville | 4-12 | 35-45 | 1.40-1.70 | 0.2-2.0 | 0.09-0.19 | 6.1-7.8 | Moderate----- | 0.37 | | | |
| | 12-60 | 12-24 | 1.50-1.80 | 0.06-0.2 | 0.05-0.19 | 7.4-8.4 | Low----------- | 0.37 | | | |
| Ma---------------- | 0-15 | --- | 0.13-0.23 | 0.6-6.0 | 0.35-0.45 | 6.1-8.4 | ------------- | ---- | --- | 2 | 25-75 |
| Martisco | 15-27 | --- | --- | 0.06-0.2 | --- | 7.9-8.4 | Low----------- | ---- | | | |
| | 27-60 | 18-30 | 1.60-1.80 | 2.0-6.0 | 0.07-0.12 | 7.9-8.4 | Low----------- | 0.17 | | | |

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

| Soil name and map symbol | Depth | Clay | Moist bulk density | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Erosion factors K | Erosion factors T | Wind erodibility group | Organic matter |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | Pct | g/cc | In/hr | In/in | pH | | | | | Pct |
| MlA, MlB2-------- Miami | 0-15 | 18-25 | 1.30-1.45 | 0.6-2.0 | 0.22-0.24 | 6.1-7.3 | Low---------- | 0.37 | 5 | 6 | 1-3 |
| | 15-39 | 27-35 | 1.35-1.45 | 0.6-2.0 | 0.18-0.21 | 5.6-6.5 | Moderate----- | 0.37 | | | |
| | 39-60 | 18-27 | 1.40-1.60 | 0.6-2.0 | 0.16-0.20 | 7.4-7.8 | Low---------- | 0.37 | | | |
| MmB2------------- Miamian | 0-9 | 14-27 | 1.30-1.50 | 0.6-2.0 | 0.20-0.24 | 5.6-7.3 | Low---------- | 0.37 | 5 | 6 | 1-3 |
| | 9-32 | 35-48 | 1.45-1.70 | 0.2-0.6 | 0.12-0.18 | 4.5-7.8 | Moderate----- | 0.37 | | | |
| | 32-60 | 16-31 | 1.60-1.82 | 0.2-0.6 | 0.06-0.10 | 7.4-8.4 | Low---------- | 0.37 | | | |
| MoB2------------- Miamian | 0-7 | 14-27 | 1.30-1.50 | 0.6-2.0 | 0.20-0.24 | 5.6-7.3 | Low---------- | 0.37 | 5 | 6 | 1-3 |
| | 7-34 | 35-48 | 1.45-1.70 | 0.2-0.6 | 0.12-0.18 | 4.5-7.8 | Moderate----- | 0.37 | | | |
| | 34-60 | 16-31 | 1.60-1.82 | 0.2-0.6 | 0.06-0.10 | 7.4-8.4 | Low---------- | 0.37 | | | |
| Mx--------------- Millgrove | 0-12 | 18-27 | 1.30-1.50 | 0.6-2.0 | 0.19-0.24 | 5.6-7.3 | Low---------- | 0.28 | 5 | 6 | 3-8 |
| | 12-36 | 18-35 | 1.40-1.70 | 0.6-2.0 | 0.12-0.16 | 6.1-7.8 | Moderate----- | 0.28 | | | |
| | 36-60 | 15-30 | 1.25-1.60 | 0.6-2.0 | 0.08-0.15 | 6.1-7.8 | Low---------- | 0.20 | | | |
| Ot*: Orthents. | | | | | | | | | | | |
| Aquents. | | | | | | | | | | | |
| Pt*. Pits | | | | | | | | | | | |
| Sg--------------- Shoals | 0-8 | 18-27 | 1.30-1.50 | 0.6-2.0 | 0.22-0.24 | 6.1-7.8 | Low---------- | 0.37 | 5 | 5 | 2-5 |
| | 8-43 | 18-33 | 1.35-1.55 | 0.6-2.0 | 0.17-0.22 | 6.1-7.8 | Low---------- | 0.37 | | | |
| | 43-60 | 12-25 | 1.35-1.60 | 0.6-2.0 | 0.12-0.21 | 6.6-8.4 | Low---------- | 0.37 | | | |
| Sk--------------- Sleeth | 0-13 | 11-22 | 1.30-1.45 | 0.6-2.0 | 0.20-0.24 | 6.6-7.3 | Low---------- | 0.32 | 5 | 5 | .5-3 |
| | 13-42 | 20-35 | 1.45-1.60 | 0.6-2.0 | 0.15-0.19 | 5.6-6.5 | Moderate----- | 0.32 | | | |
| | 42-46 | 20-35 | 1.40-1.60 | 0.6-2.0 | 0.14-0.16 | 6.6-8.4 | Moderate----- | 0.32 | | | |
| | 46-60 | 2-5 | 1.60-1.80 | >20 | 0.02-0.04 | 7.9-8.4 | Low---------- | 0.10 | | | |
| Sn--------------- Sloan | 0-13 | 27-33 | 1.25-1.50 | 0.6-2.0 | 0.18-0.22 | 6.1-7.8 | Moderate----- | 0.37 | 5 | 6 | 3-6 |
| | 13-32 | 22-35 | 1.25-1.55 | 0.2-2.0 | 0.15-0.19 | 6.1-8.4 | Moderate----- | 0.37 | | | |
| | 32-60 | 10-30 | 1.20-1.50 | 0.2-2.0 | 0.13-0.18 | 6.6-8.4 | Low---------- | 0.37 | | | |
| Ts--------------- Treaty | 0-8 | 18-27 | 1.50-1.70 | 0.6-2.0 | 0.23-0.25 | 5.6-7.3 | Low---------- | 0.32 | 5 | 6 | 4-6 |
| | 8-25 | 28-35 | 1.50-1.70 | 0.6-2.0 | 0.18-0.20 | 6.1-7.8 | Moderate----- | 0.43 | | | |
| | 25-51 | 20-35 | 1.50-1.70 | 0.6-2.0 | 0.15-0.19 | 6.6-7.8 | Moderate----- | 0.43 | | | |
| | 51-60 | 15-27 | 1.70-1.90 | 0.2-0.6 | 0.17-0.19 | 7.4-8.4 | Low---------- | 0.43 | | | |
| Wb--------------- Washtenaw | 0-8 | 15-27 | 1.30-1.45 | 0.6-2.0 | 0.22-0.24 | 6.1-7.3 | Low---------- | 0.37 | 5 | 5 | 3-7 |
| | 8-20 | 15-27 | 1.30-1.50 | 0.6-2.0 | 0.20-0.22 | 6.1-7.3 | Low---------- | 0.37 | | | |
| | 20-50 | 28-35 | 1.40-1.60 | 0.06-0.2 | 0.15-0.20 | 6.1-7.3 | Moderate----- | 0.37 | | | |
| | 50-60 | 15-25 | 1.45-1.65 | 0.06-0.2 | 0.05-0.19 | 7.4-8.4 | Moderate----- | 0.37 | | | |
| We--------------- Westland | 0-10 | 18-27 | 1.30-1.45 | 0.6-2.0 | 0.18-0.21 | 5.6-7.3 | Moderate----- | 0.28 | 5 | 6 | 2-6 |
| | 10-30 | 27-35 | 1.45-1.60 | 0.6-2.0 | 0.15-0.19 | 5.6-7.3 | Moderate----- | 0.28 | | | |
| | 30-45 | 15-30 | 1.40-1.60 | 0.6-2.0 | 0.14-0.16 | 5.6-7.3 | Moderate----- | 0.28 | | | |
| | 45-60 | 1-7 | 1.50-1.75 | >20 | 0.02-0.04 | 7.4-8.4 | Low---------- | 0.10 | | | |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

| Soil name and map symbol | Hydrologic group | Flooding | | | High water table | | | Bedrock | | Potential frost action | Risk of corrosion | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness | | Uncoated steel | Concrete |
| | | | | | Ft | | | In | | | | |
| CeB2, CfB2: Celina | C | None | --- | --- | 2.0-3.5 | Perched | Jan-Apr | >60 | --- | High | High | Moderate. |
| CrA, CsA: Crosby | C | None | --- | --- | 1.0-3.0 | Perched | Jan-Apr | >60 | --- | High | High | Moderate. |
| Cy: Cyclone | B/D | None | --- | --- | +.5-1.0 | Apparent | Dec-May | >60 | --- | High | High | Low. |
| EdA, EdB2, EdC2, EdD2, EdE2, ExC3, ExD3: Eldean | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate | High | Moderate. |
| Ge: Genesee | B | Occasional | Brief | Oct-Jun | >6.0 | --- | --- | >60 | --- | Moderate | Low | Low. |
| La: Landes | B | Rare | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate | Low | Low. |
| LeB2, LeC2, LeD2, LeE2, LhC3, LhD3, LsB2, LsC2, LsD2, LsE2, LxC3, LxD3: Losantville | C | None | --- | --- | 4.0-6.0 | Perched | Jan-Apr | >60 | --- | Moderate | Moderate | Moderate. |
| Ma: Martisco | B/D | None | --- | --- | +1-0.5 | Apparent | Oct-Jun | >60 | --- | High | High | Low. |
| MlA, MlB2: Miami | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate | Moderate | Moderate. |
| MmB2, MoB2: Miamian | C | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate | Moderate | Moderate. |
| Mx: Millgrove | B/D | None | --- | --- | +1-1.0 | Apparent | Nov-May | >60 | --- | High | High | Low. |
| Ot*: | | | | | | | | | | | | |
| Orthents. | | | | | | | | | | | | |
| Aquents. | | | | | | | | | | | | |
| Pt*. Pits | | | | | | | | | | | | |

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

| Soil name and map symbol | Hydro-logic group | Flooding | | | High water table | | | Bedrock | | Potential frost action | Risk of corrosion | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness | | Uncoated steel | Concrete |
| | | | | | Ft | | | In | | | | |
| Sg-----------------<br>Shoals | C | Occasional | Brief----- | Oct-Jun | 0.5-1.5 | Apparent | Jan-Apr | >60 | --- | High----- | High----- | Low. |
| Sk-----------------<br>Sleeth | C | None-------- | --- | --- | 1.0-3.0 | Apparent | Jan-Apr | >60 | --- | High----- | High----- | Low. |
| Sn-----------------<br>Sloan | B/D | Occasional | Brief----- | Nov-Jun | 0-1.0 | Apparent | Nov-Jun | >60 | --- | High----- | High----- | Low. |
| Ts-----------------<br>Treaty | B/D | None-------- | --- | --- | +.5-1.0 | Apparent | Dec-May | >60 | --- | High----- | High----- | Low. |
| Wb-----------------<br>Washtenaw | C/D | None-------- | --- | --- | +.5-1.0 | Apparent | Dec-May | >60 | --- | High----- | High----- | Low. |
| We-----------------<br>Westland | B/D | None-------- | --- | --- | +.5-1.0 | Apparent | Dec-May | >60 | --- | High----- | High----- | Low. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

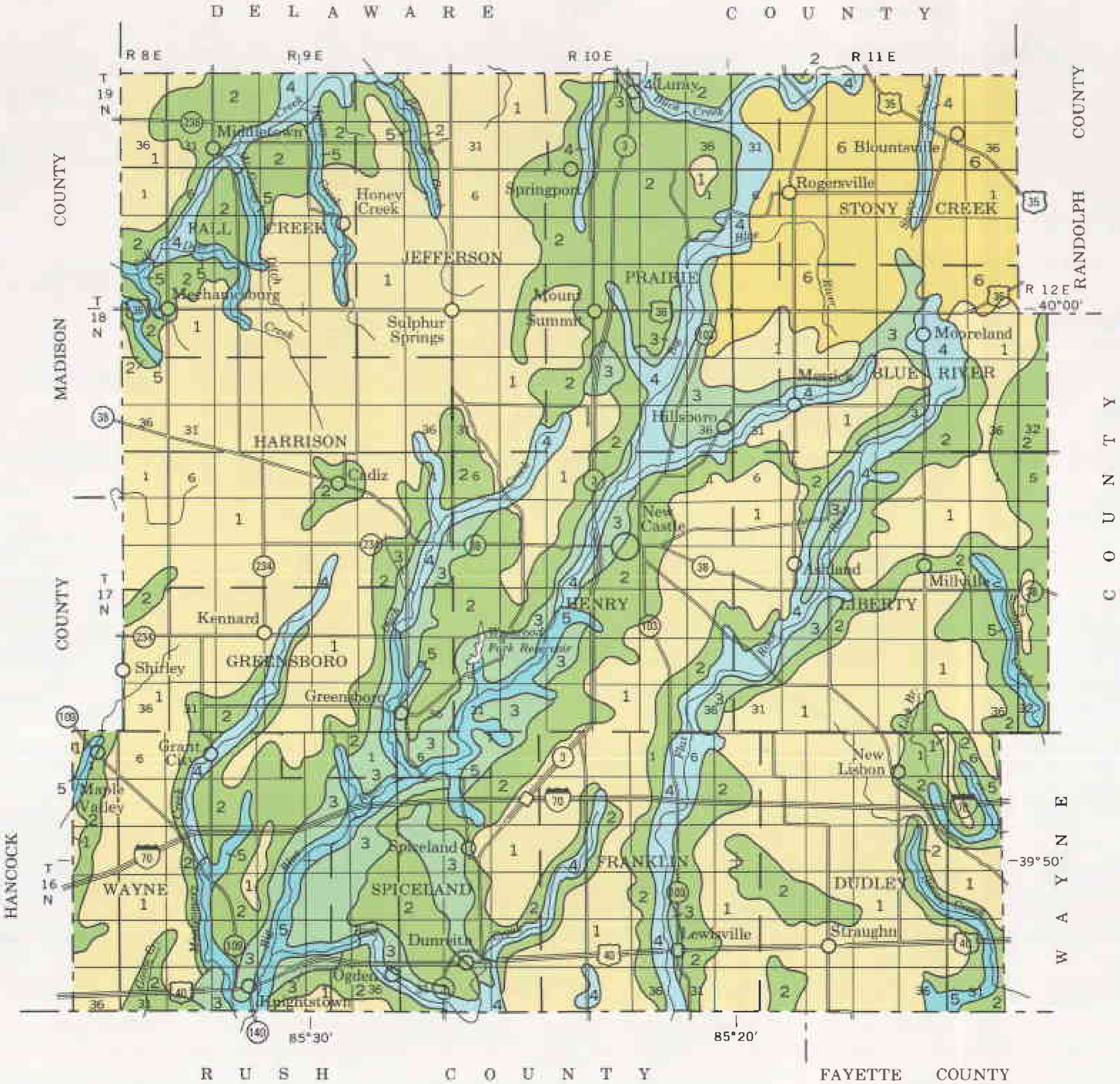
| Soil name | Family or higher taxonomic class |
|---|---|
| Aquents | Loamy, mixed, mesic Haplaquents |
| Celina | Fine, mixed, mesic Aquic Hapludalfs |
| Crosby | Fine, mixed, mesic Aeric Ochraqualfs |
| *Cyclone | Fine-silty, mixed, mesic Typic Argiaquolls |
| Eldean | Fine, mixed, mesic Typic Hapludalfs |
| Genesee | Fine-loamy, mixed, nonacid, mesic Typic Udifluvents |
| Landes | Coarse-loamy, mixed, mesic Fluventic Hapludolls |
| Losantville | Fine, mixed, mesic Typic Hapludalfs |
| Martisco | Fine-silty, carbonatic, mesic Histic Humaquepts |
| Miami | Fine-loamy, mixed, mesic Typic Hapludalfs |
| Miamian | Fine, mixed, mesic Typic Hapludalfs |
| *Millgrove | Fine-loamy, mixed, mesic Typic Argiaquolls |
| Orthents | Loamy, mixed, mesic Udorthents |
| Shoals | Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents |
| Sleeth | Fine-loamy, mixed, mesic Aeric Ochraqualfs |
| Sloan | Fine-loamy, mixed, mesic Fluvaquentic Haplaquolls |
| Treaty | Fine-silty, mixed, mesic Typic Argiaquolls |
| *Washtenaw | Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents |
| Westland | Fine-loamy, mixed, mesic Typic Argiaquolls |

☆ U.S. GOVERNMENT PRINTING OFFICE : 1986 O - 486-599 : QL 3

# Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.




# LEGEND*

1 — CROSBY-CYCLONE-MIAMIAN: Deep, nearly level and gently sloping, somewhat poorly drained, poorly drained, and well drained, medium textured and moderately fine textured soils formed in loess or silty material and in the underlying loamy glacial till; on till plains and moraines

2 — MIAMIAN-LOSANTVILLE: Deep, gently sloping to steep, well drained, medium textured and moderately fine textured soils formed in glacial till or in a thin mantle of loess and the underlying loamy glacial till; on till plains and moraines

3 — ELDEAN: Nearly level to strongly sloping, well drained, medium textured and moderately fine textured soils that are moderately deep over sand and gravel; formed in outwash material on outwash plains, moraines, and terraces

4 — WESTLAND-MILLGROVE-MARTISCO: Deep, nearly level, very poorly drained, medium textured or mucky soils formed in glacial outwash sediments and organic deposits; on outwash plains, terraces, and valley trains

5 — GENESEE-SHOALS-LANDES: Deep, nearly level, well drained and somewhat poorly drained, medium textured soils formed in loamy alluvial deposits; on bottom land

6 — LOSANTVILLE-CROSBY-MIAMIAN: Deep, nearly level to steep, well drained and somewhat poorly drained, medium textured and moderately fine textured soils formed in glacial till or in a thin mantle of loess and the underlying loamy glacial till; on till plains and moraines

*Texture terms in the descriptive headings refer to the surface layer of the major soils in the map units.

COMPILED 1984

SECTIONALIZED TOWNSHIP

| | | | | | |
|---|---|---|---|---|---|
| 6 | 5 | 4 | 3 | 2 | 1 |
| 7 | 8 | 9 | 10 | 11 | 12 |
| 18 | 17 | 16 | 15 | 14 | 13 |
| 19 | 20 | 21 | 22 | 23 | 24 |
| 30 | 29 | 28 | 27 | 26 | 25 |
| 31 | 32 | 33 | 34 | 35 | 36 |

N

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION
INDIANA DEPARTMENT OF NATURAL RESOURCES
SOIL AND WATER CONSERVATION COMMITTEE

# GENERAL SOIL MAP

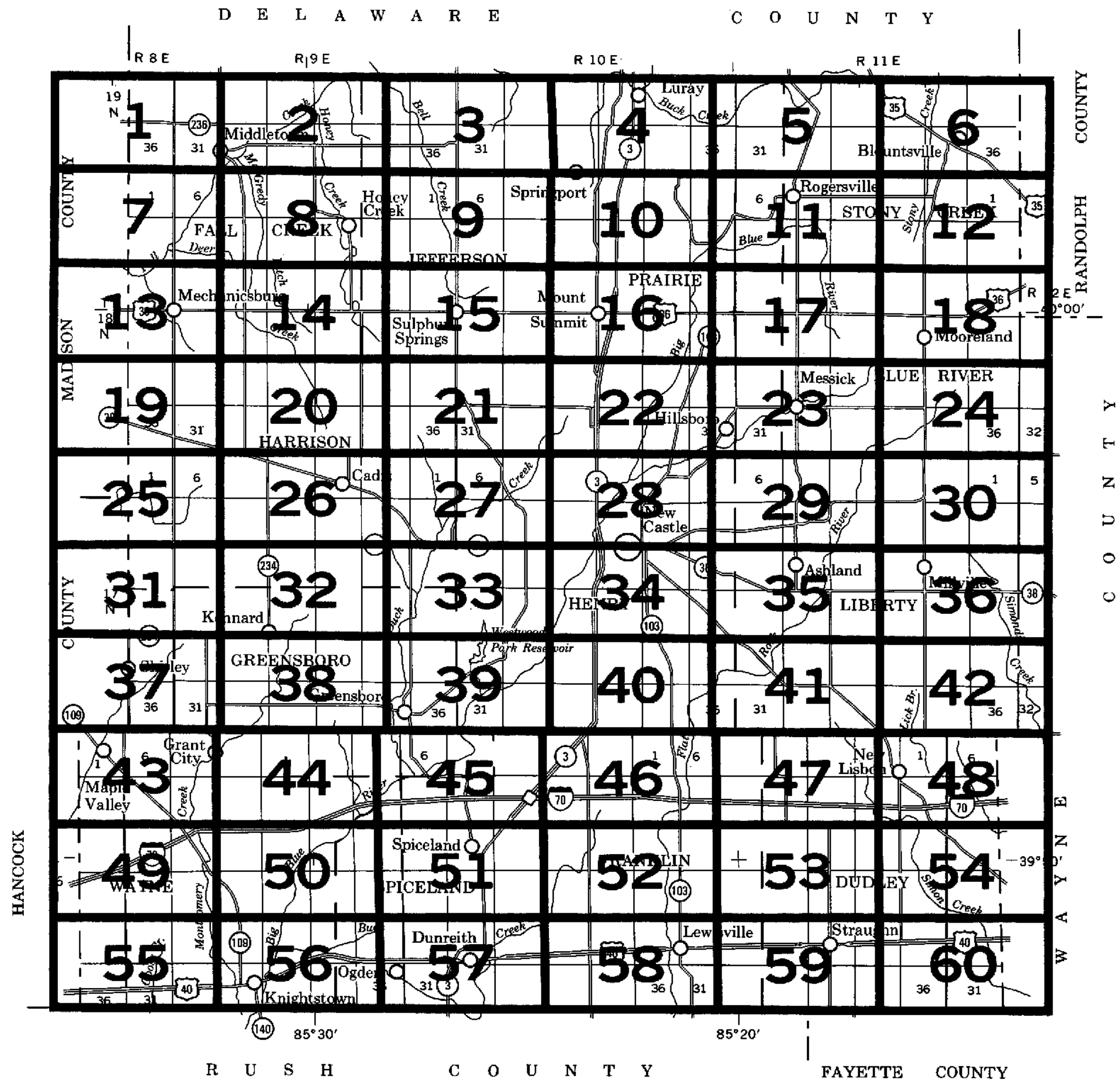
## HENRY COUNTY, INDIANA

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

*Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.*




| | | | | | |
|---|---|---|---|---|---|
| 6 | 5 | 4 | 3 | 2 | 1 |
| 7 | 8 | 9 | 10 | 11 | 12 |
| 18 | 17 | 16 | 15 | 14 | 13 |
| 19 | 20 | 21 | 22 | 23 | 24 |
| 30 | 29 | 28 | 27 | 26 | 25 |
| 31 | 32 | 33 | 34 | 35 | 36 |

SECTIONALIZED TOWNSHIP

N

# INDEX TO MAP SHEETS

## HENRY COUNTY, INDIANA

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

# SOIL LEGEND

Map symbols consist of a combination of letters or of letters and a number. The first capital letter is the initial one of the map unit name. The lowercase letter that follows separates map units having names that begin with the same letter, except that it does not separate sloping or eroded phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 indicates that the soil is eroded and 3 that it is severely eroded.

| | |
|---|---|
| CeB2 | Celina silt loam, 1 to 6 percent slopes, eroded |
| CfB2 | Celina silt loam, stony subsoil, 1 to 6 percent slopes, eroded |
| CrA | Crosby silt loam, 0 to 3 percent slopes |
| CsA | Crosby silt loam, stony subsoil, 0 to 3 percent slopes |
| Cy | Cyclone silty clay loam |
| EdA | Eldean silt loam, 0 to 2 percent slopes |
| EdB2 | Eldean silt loam, 2 to 6 percent slopes, eroded |
| EdC2 | Eldean silt loam, 6 to 12 percent slopes, eroded |
| EdD2 | Eldean silt loam, 12 to 18 percent slopes, eroded |
| EdE2 | Eldean silt loam, 18 to 35 percent slopes, eroded |
| ExC3 | Eldean clay loam, 6 to 12 percent slopes, severely eroded |
| ExD3 | Eldean clay loam, 12 to 18 percent slopes, severely eroded |
| Ge | Genesee loam, occasionally flooded |
| La | Landes loam, rarely flooded |
| LeB2 | Losantville silt loam, 2 to 6 percent slopes, eroded |
| LeC2 | Losantville silt loam, 6 to 12 percent slopes, eroded |
| LeD2 | Losantville silt loam, 12 to 18 percent slopes, eroded |
| LeE2 | Losantville silt loam, 18 to 30 percent slopes, eroded |
| LhC3 | Losantville clay loam, 6 to 12 percent slopes, severely eroded |
| LhD3 | Losantville clay loam, 12 to 18 percent slopes, severely eroded |
| LsB2 | Losantville silt loam, stony subsoil, 2 to 6 percent slopes, eroded |
| LsC2 | Losantville silt loam, stony subsoil, 6 to 12 percent slopes, eroded |
| LsD2 | Losantville silt loam, stony subsoil, 12 to 18 percent slopes, eroded |
| LsE2 | Losantville silt loam, stony subsoil, 18 to 30 percent slopes, eroded |
| LxC3 | Losantville clay loam, stony subsoil, 6 to 12 percent slopes, severely eroded |
| LxD3 | Losantville clay loam, stony subsoil, 12 to 18 percent slopes, severely eroded |
| Ma | Martisco muck, drained |
| MlA | Miami silt loam, gravelly substratum, 0 to 2 percent slopes |
| MlB2 | Miami silt loam, gravelly substratum, 2 to 6 percent slopes, eroded |
| MmB2 | Miamian silt loam, 2 to 6 percent slopes, eroded |
| MoB2 | Miamian silt loam, stony subsoil, 2 to 6 percent slopes, eroded |
| Mx | Millgrove loam |
| Ot | Orthents and Aquents, loamy |
| Pt | Pits, gravel |
| Sg | Shoals loam, occasionally flooded |
| Sk | Sleeth silt loam |
| Sn | Sloan silty clay loam, occasionally flooded |
| Ts | Treaty silt loam, stony subsoil |
| Wb | Washtenaw silt loam |
| We | Westland silt loam |

# CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

## CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label) — Hedley Airstrip

- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water, w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

## WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

## SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — CrA EdB2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

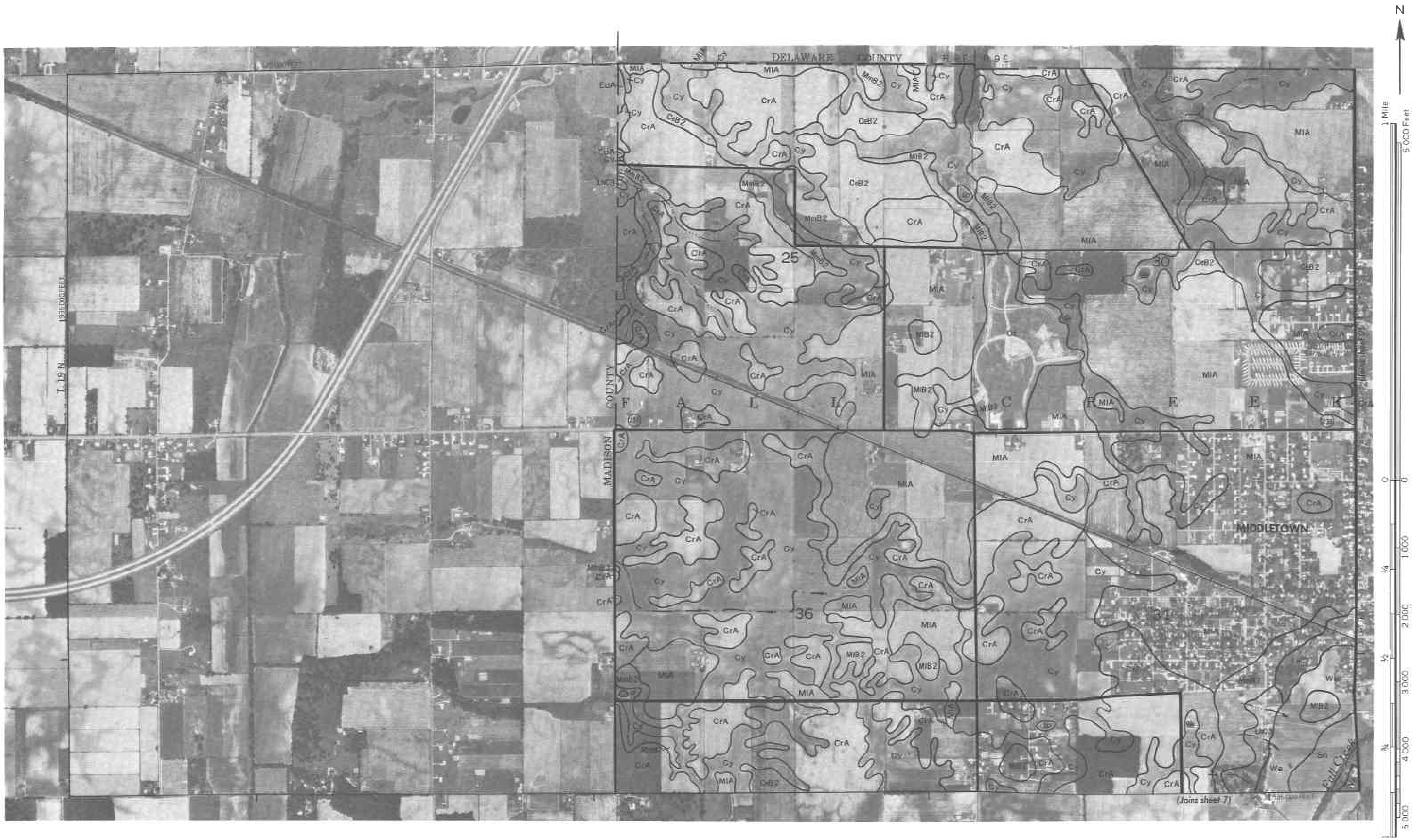
GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot




HENRY COUNTY, INDIANA NO. 1

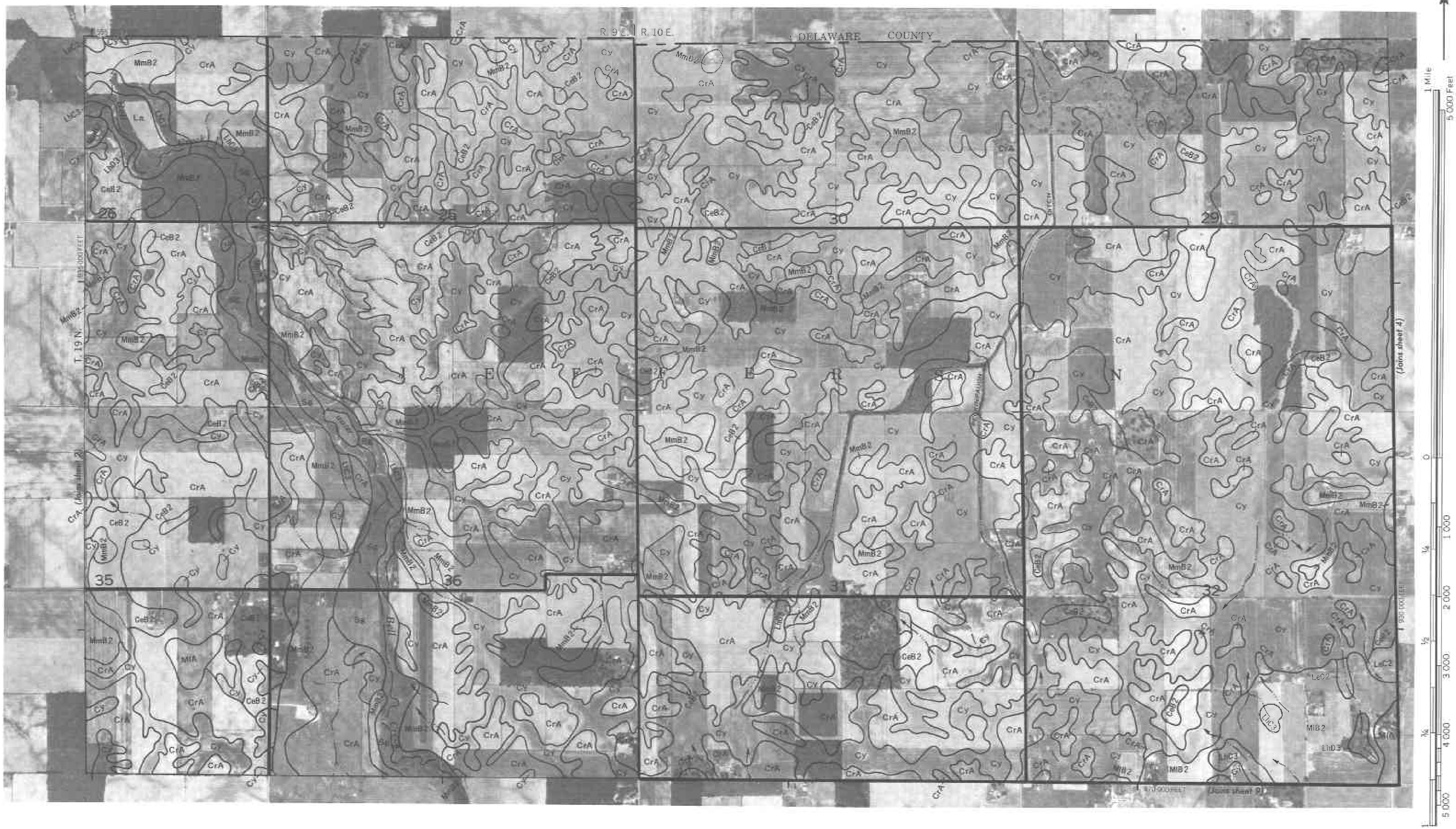
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2


HENRY COUNTY, INDIANA NO. 2

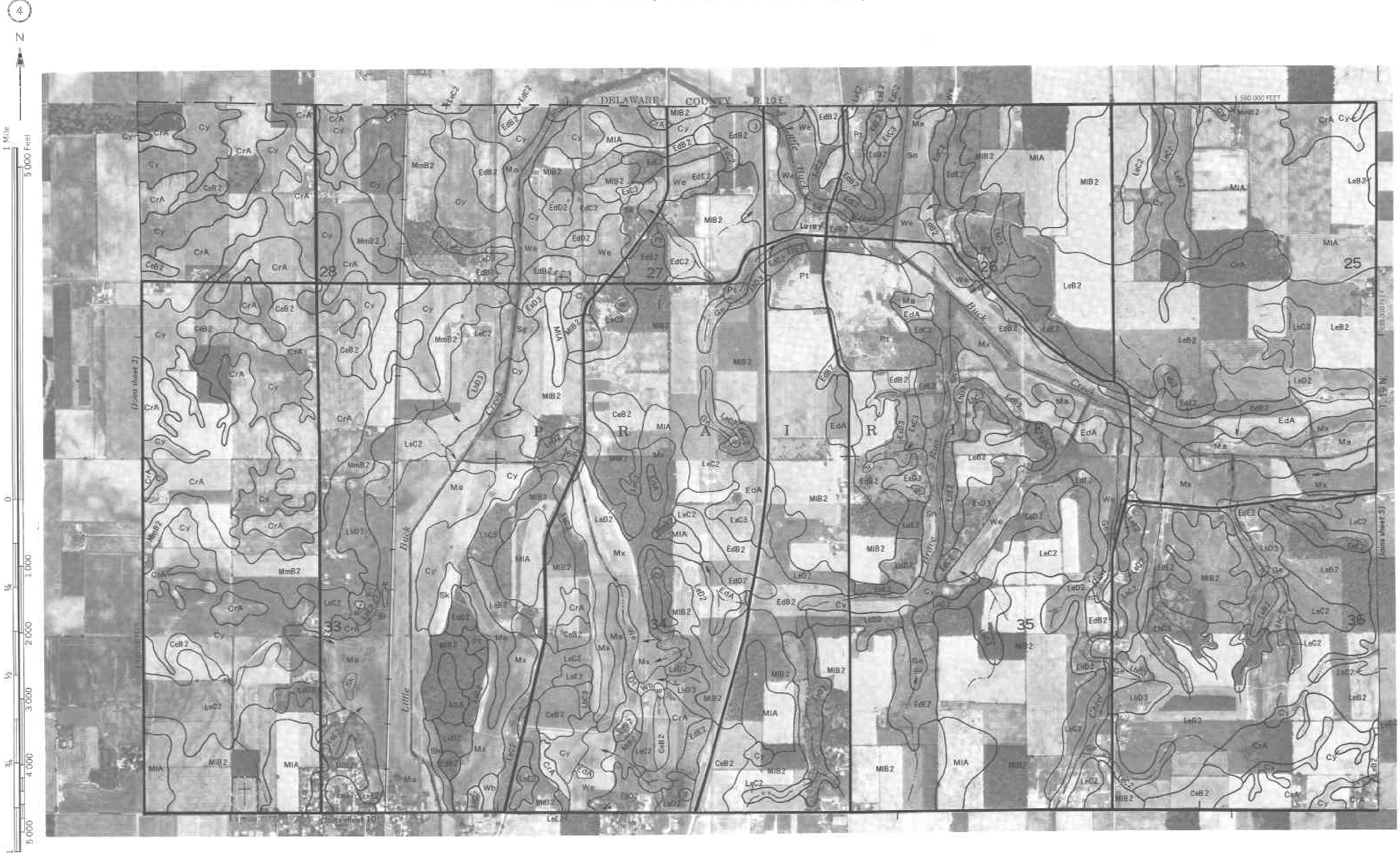
3

N




HENRY COUNTY, INDIANA NO. 3

This map is compiled on 1970 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



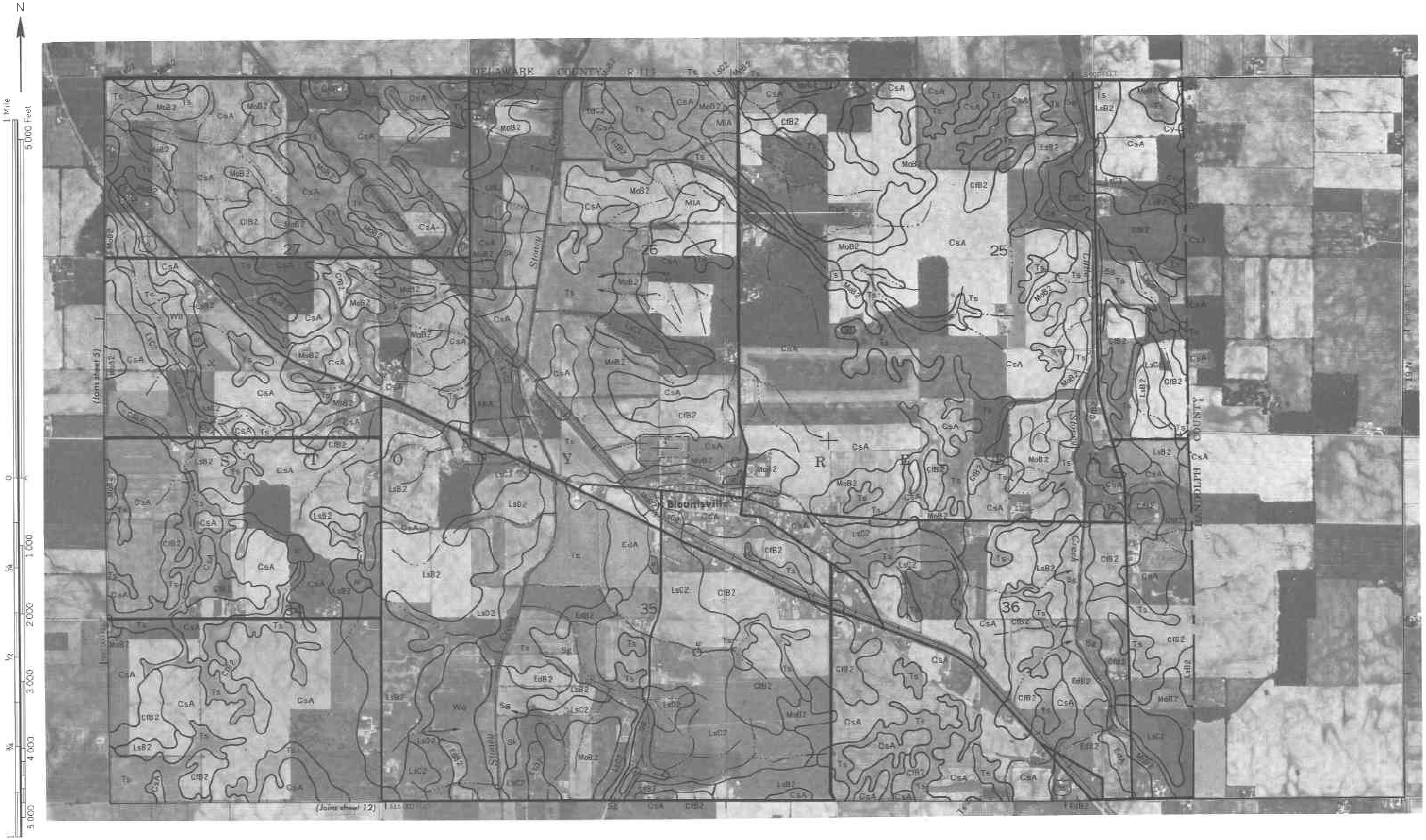

This map is compiled on 1973 aerial photographs by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HENRY COUNTY, INDIANA NO. 4

5


HENRY COUNTY, INDIANA NO. 5

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



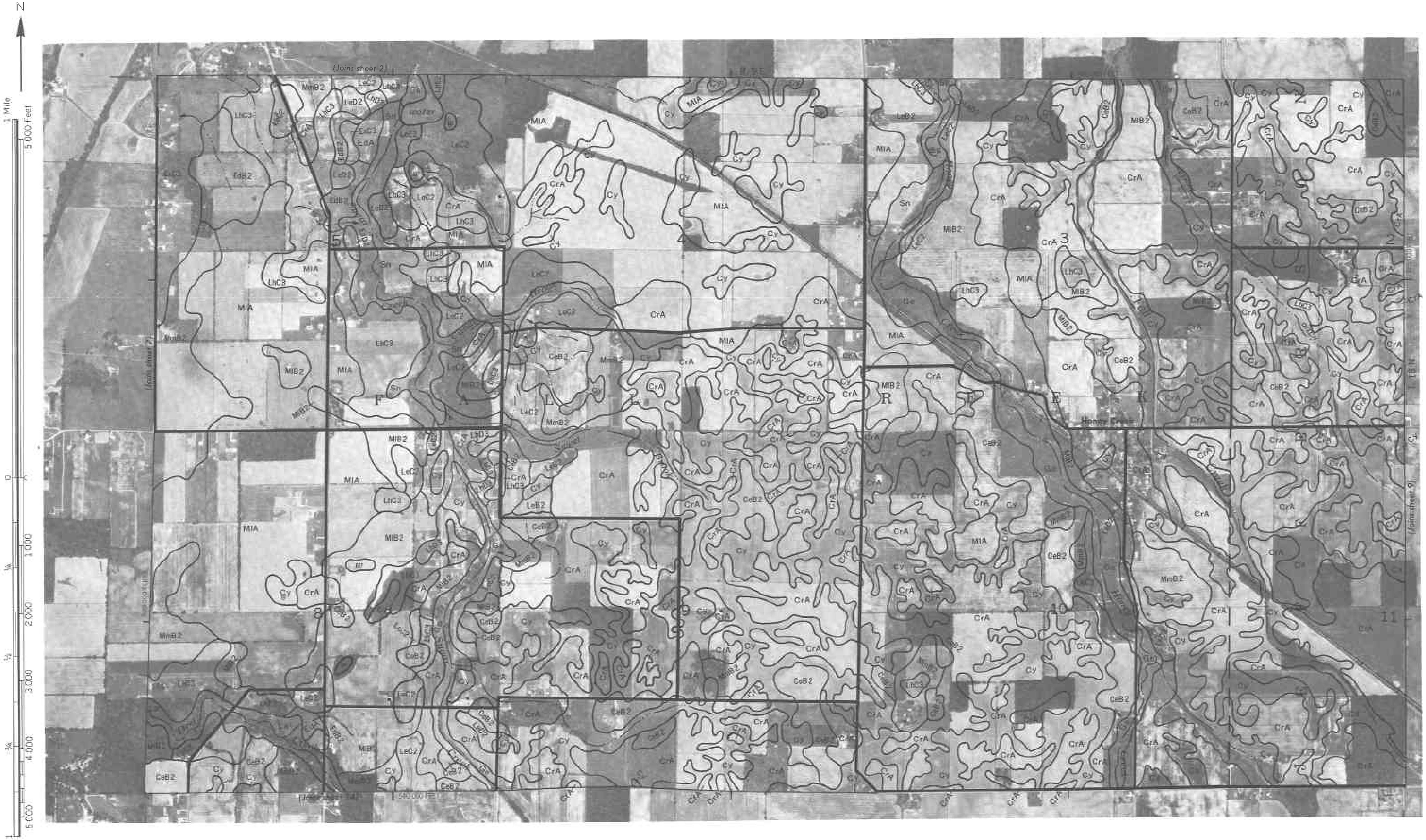

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HENRY COUNTY, INDIANA NO. 6


HENRY COUNTY, INDIANA NO. 7

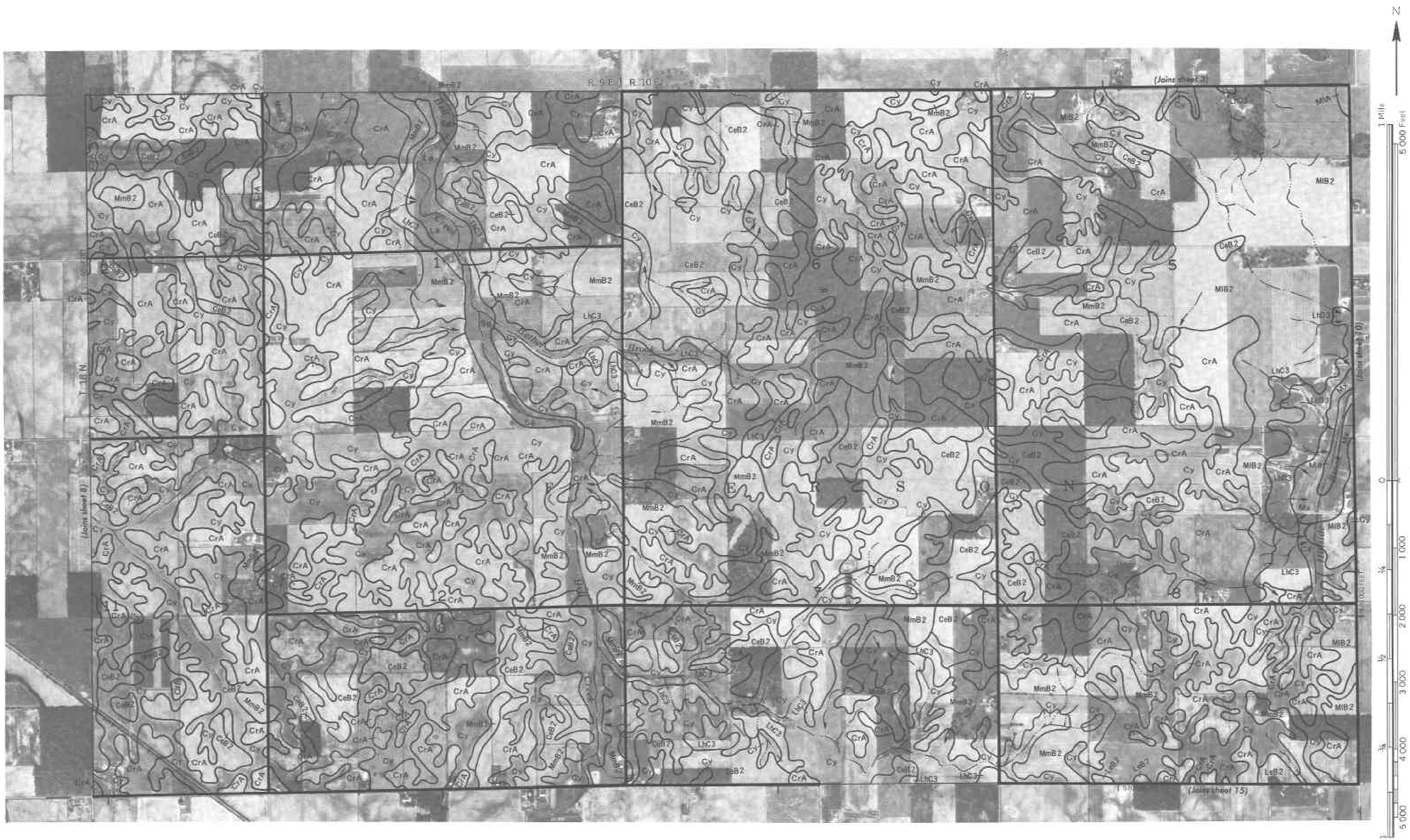
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

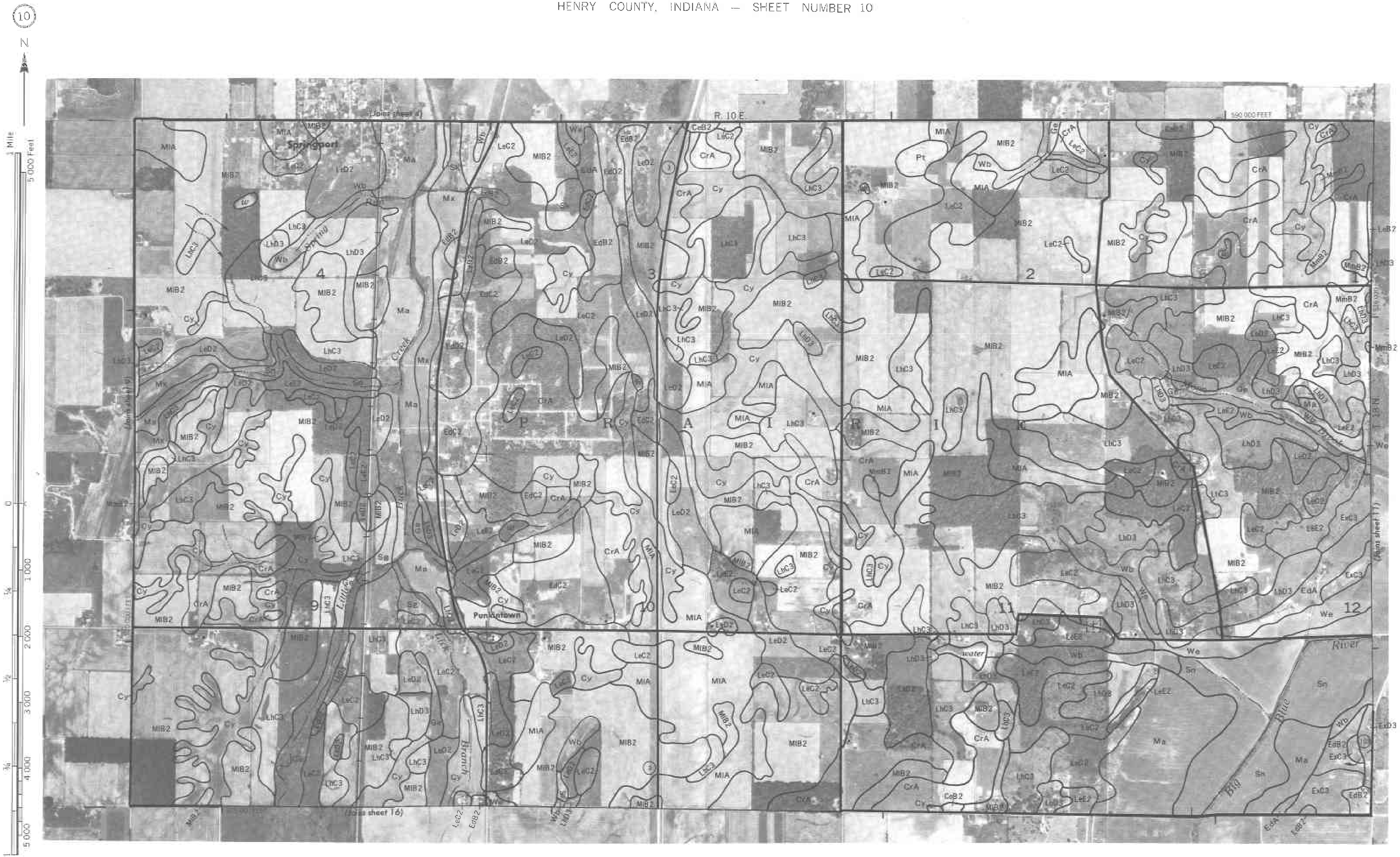
8



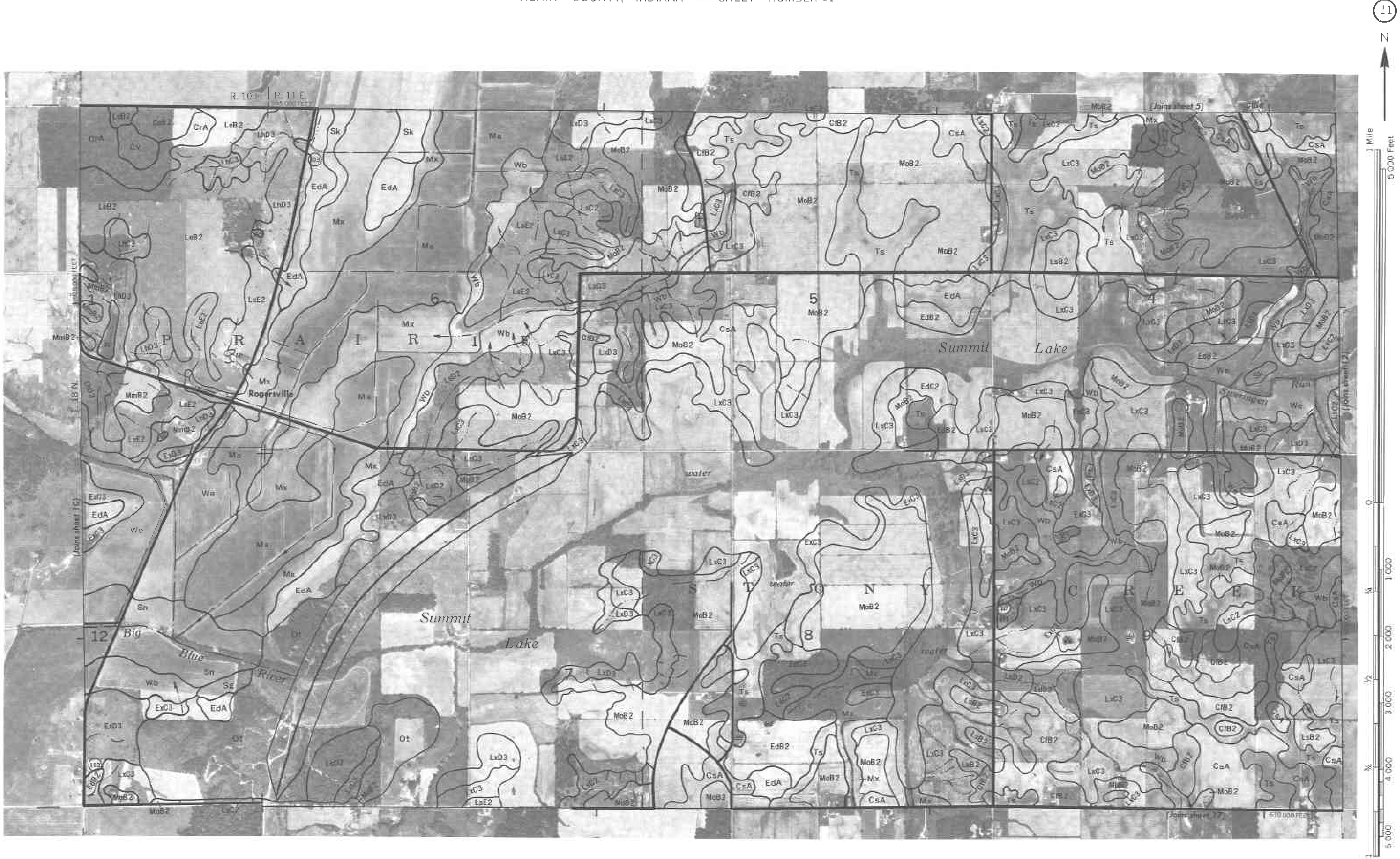

HENRY COUNTY, INDIANA NO. 8

HENRY COUNTY, INDIANA NO. 9





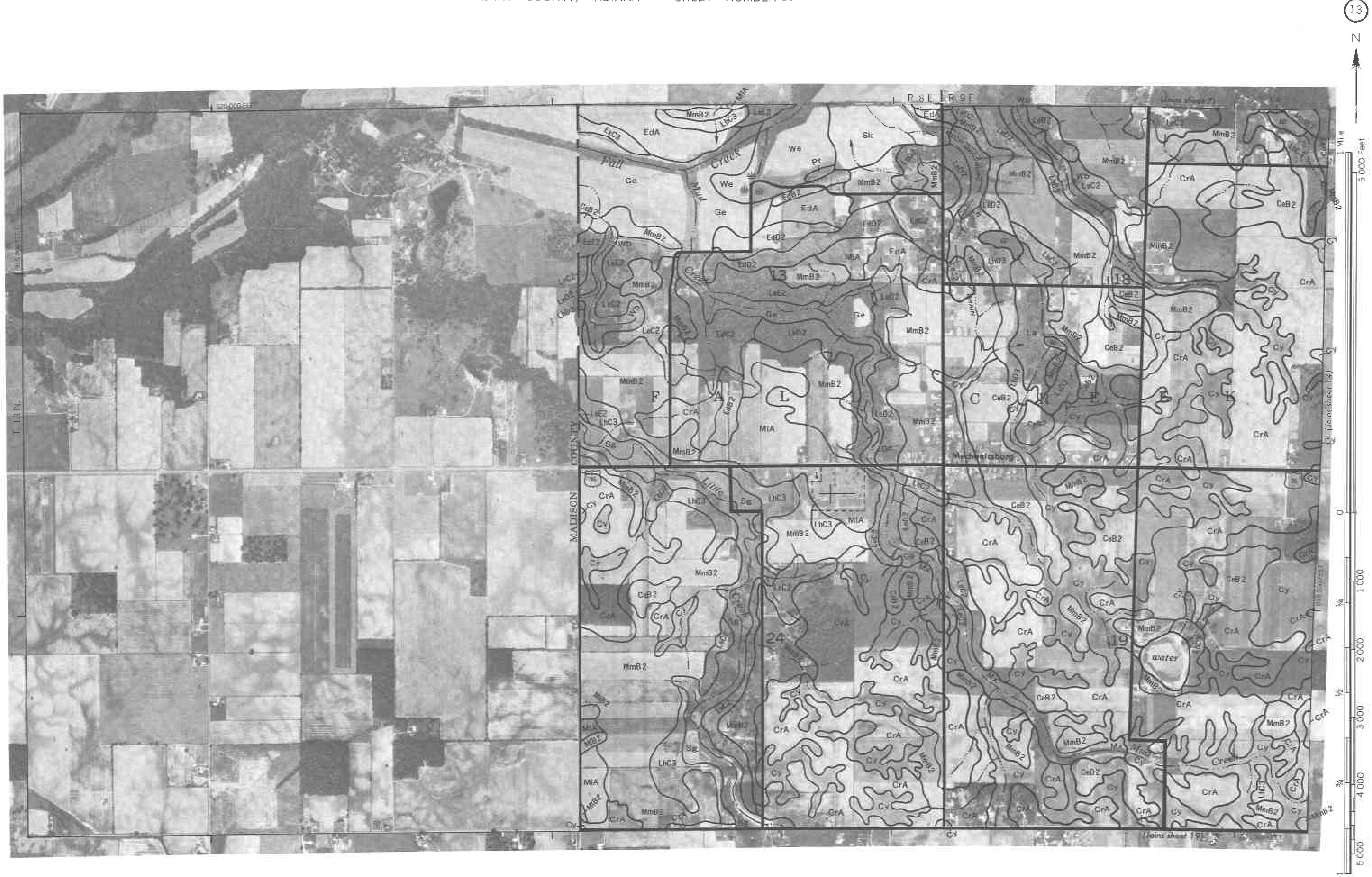

HENRY COUNTY, INDIANA NO. 10




HENRY COUNTY, INDIANA NO. 11

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

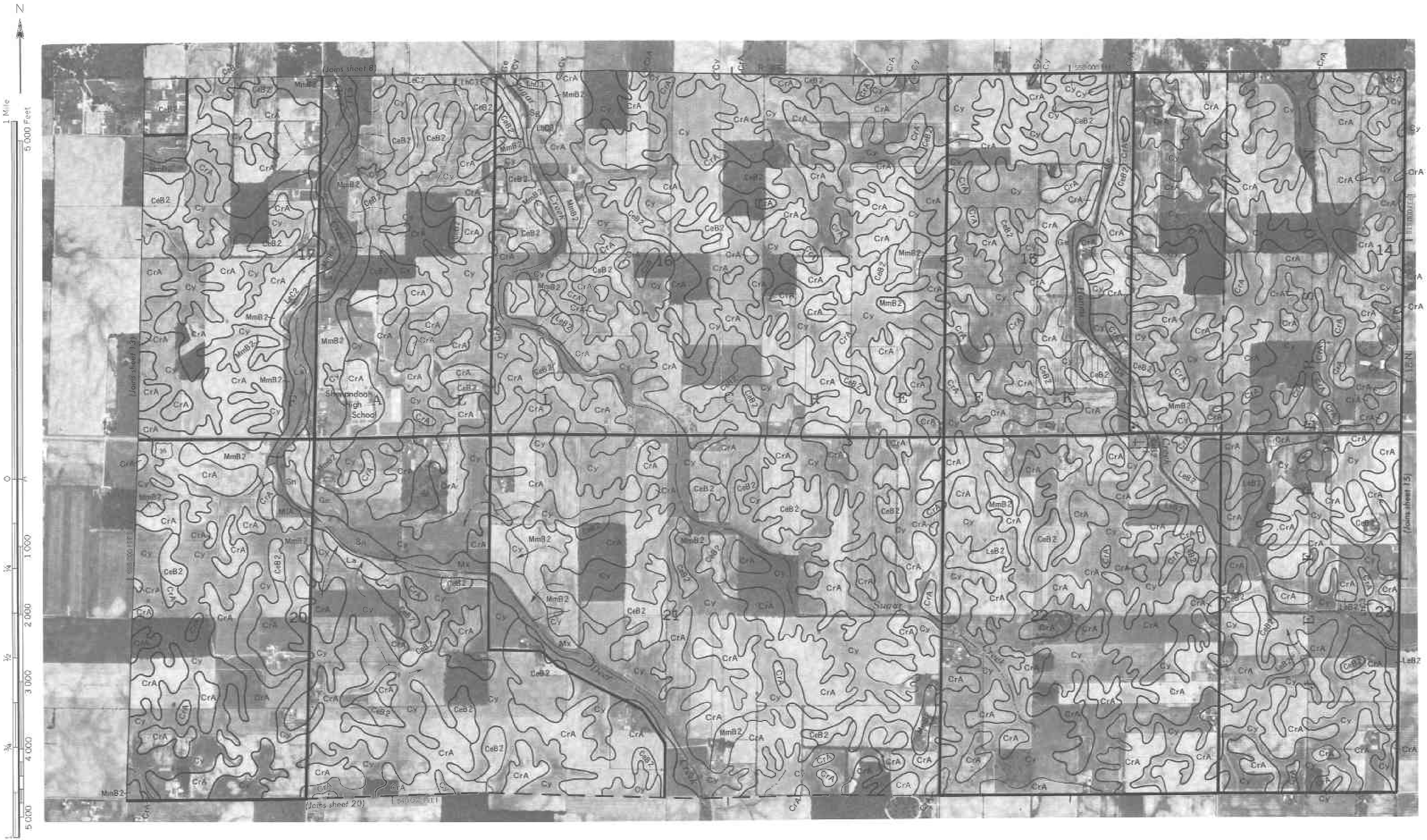

12
N
1 Mile
5 000 Feet
(Joins sheet 6)
(Joins sheet 17)
(Joins sheet 18)
STONY CREEK
RANDOLPH COUNTY
HENRY COUNTY, INDIANA NO. 12



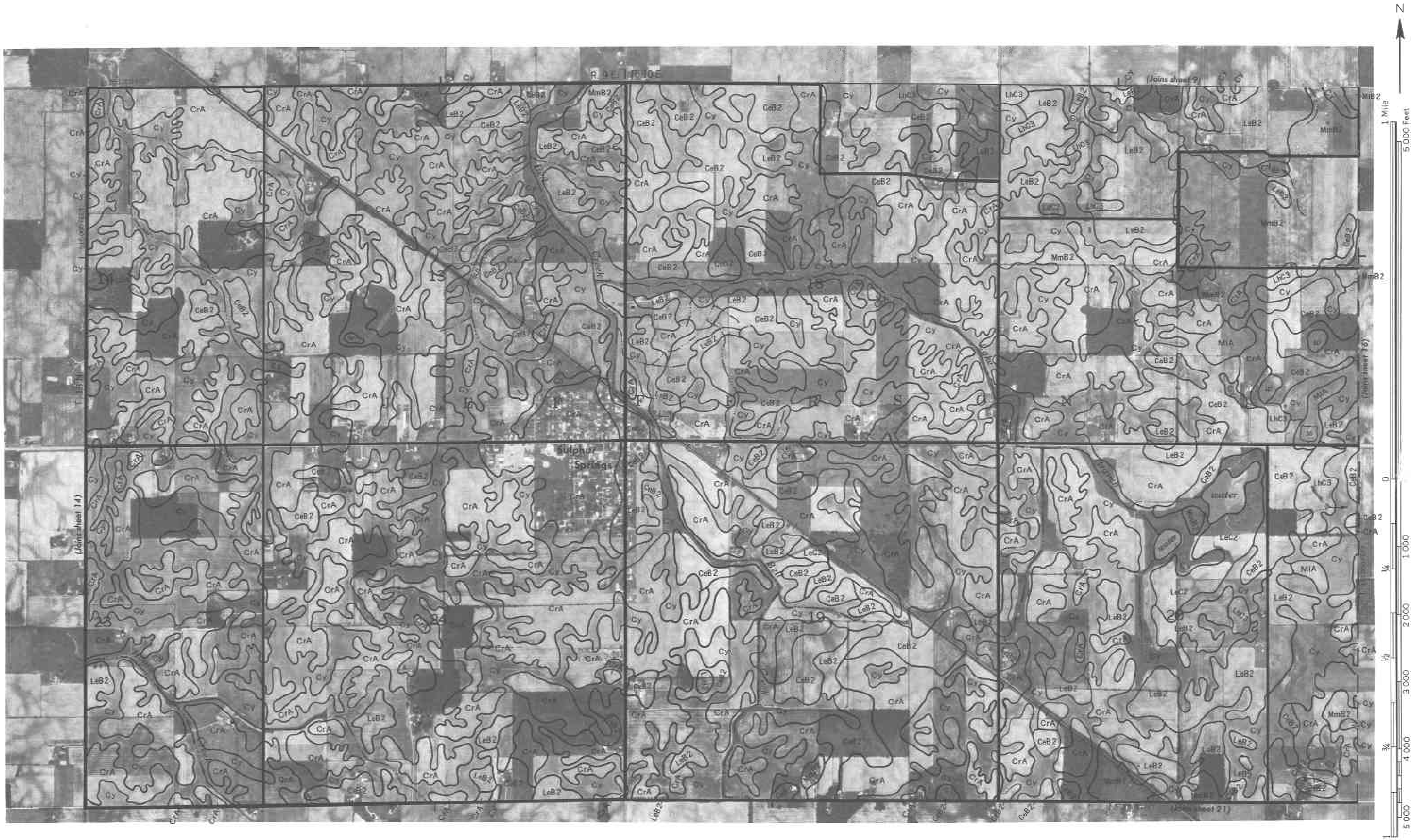

HENRY COUNTY, INDIANA NO. 13

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

14




HENRY COUNTY, INDIANA NO. 14



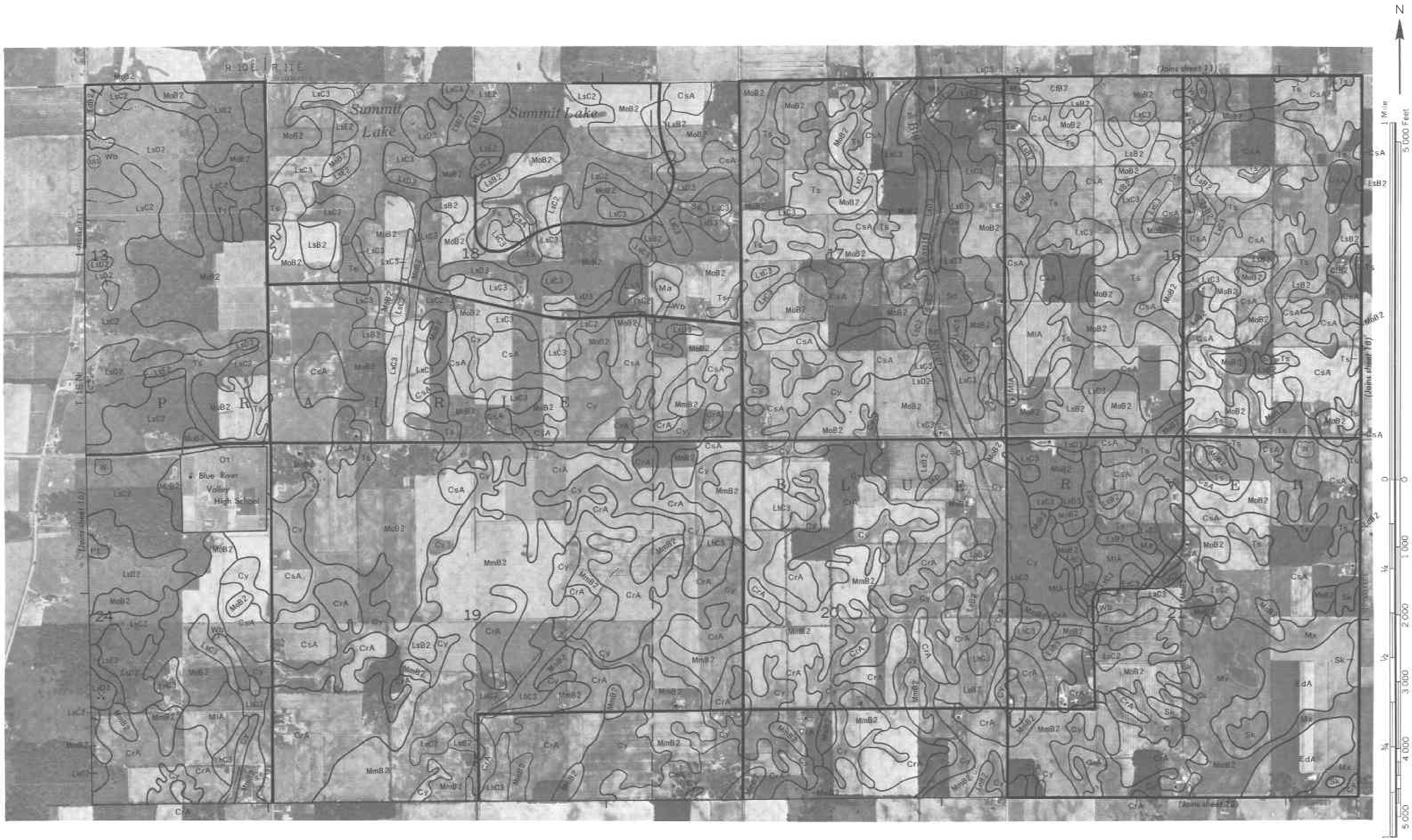

HENRY COUNTY, INDIANA NO. 15

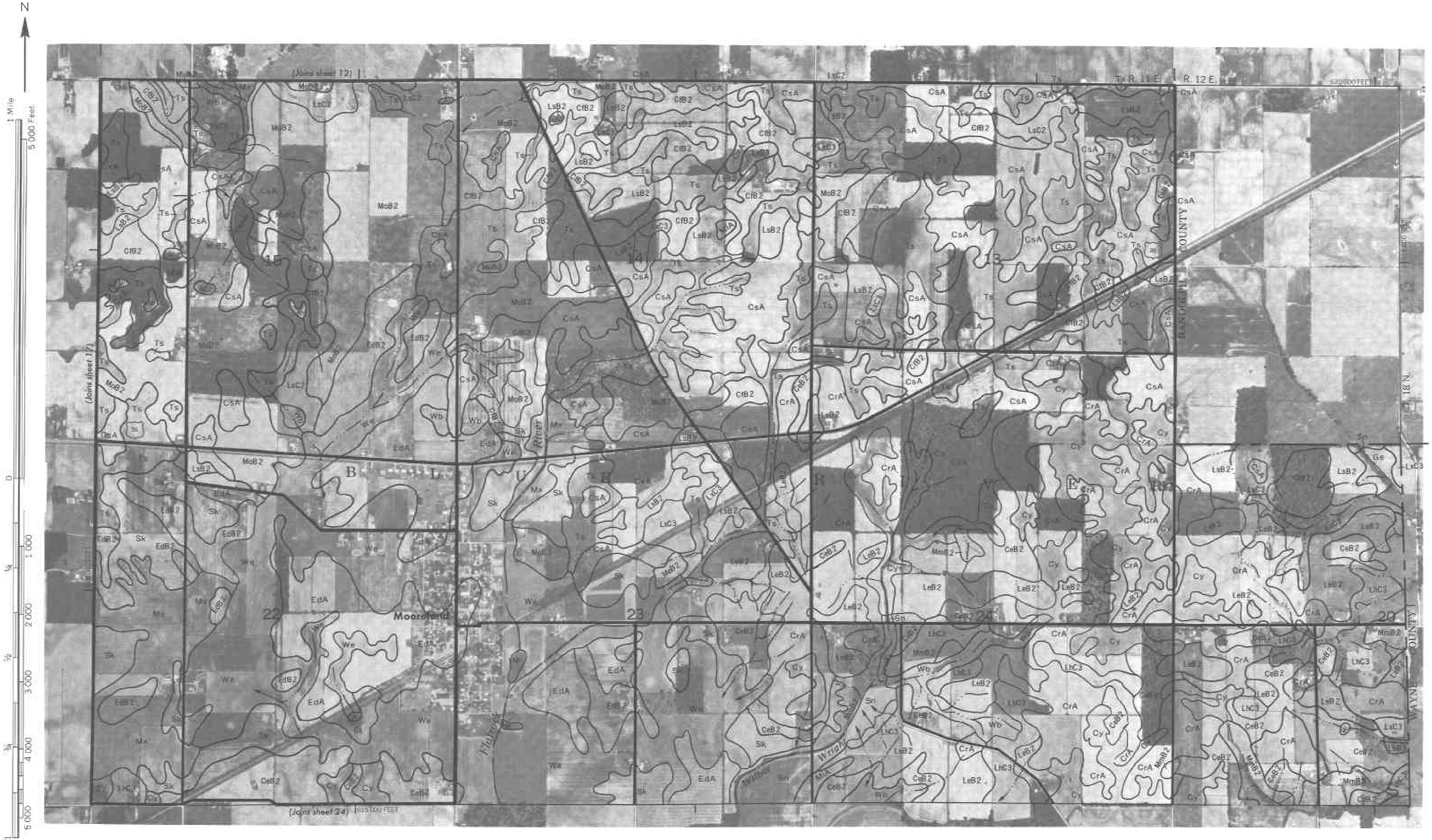
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

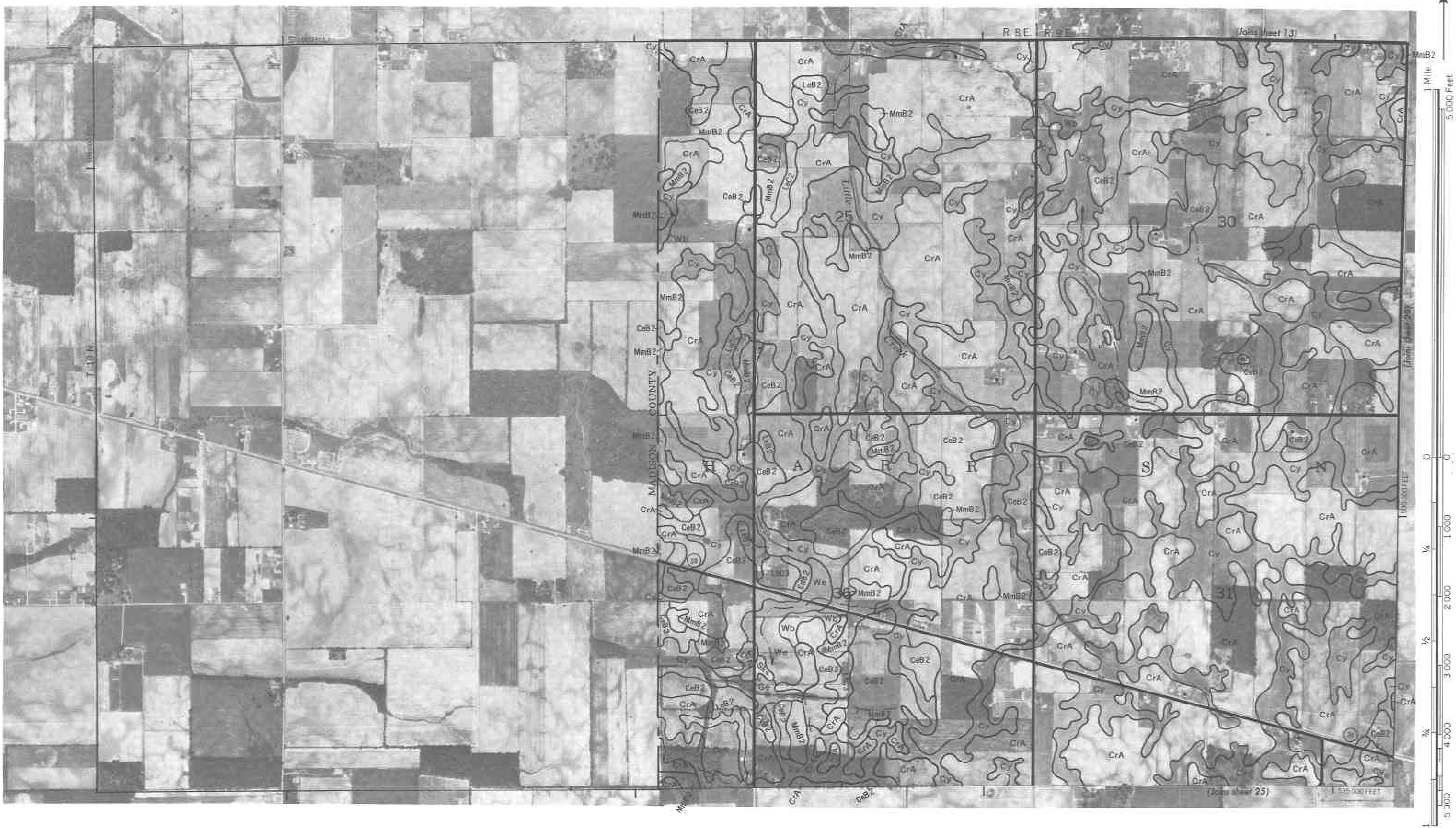

N
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
(Joins sheet 10)
R. 10 E.
(Joins sheet 15)
(Joins sheet 17)
(Joins sheet 22)
Mount Summit
Blue River
Big Blue
P R A I R I E
15
14
13
16
21
22
23
24

HENRY COUNTY, INDIANA NO. 17

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

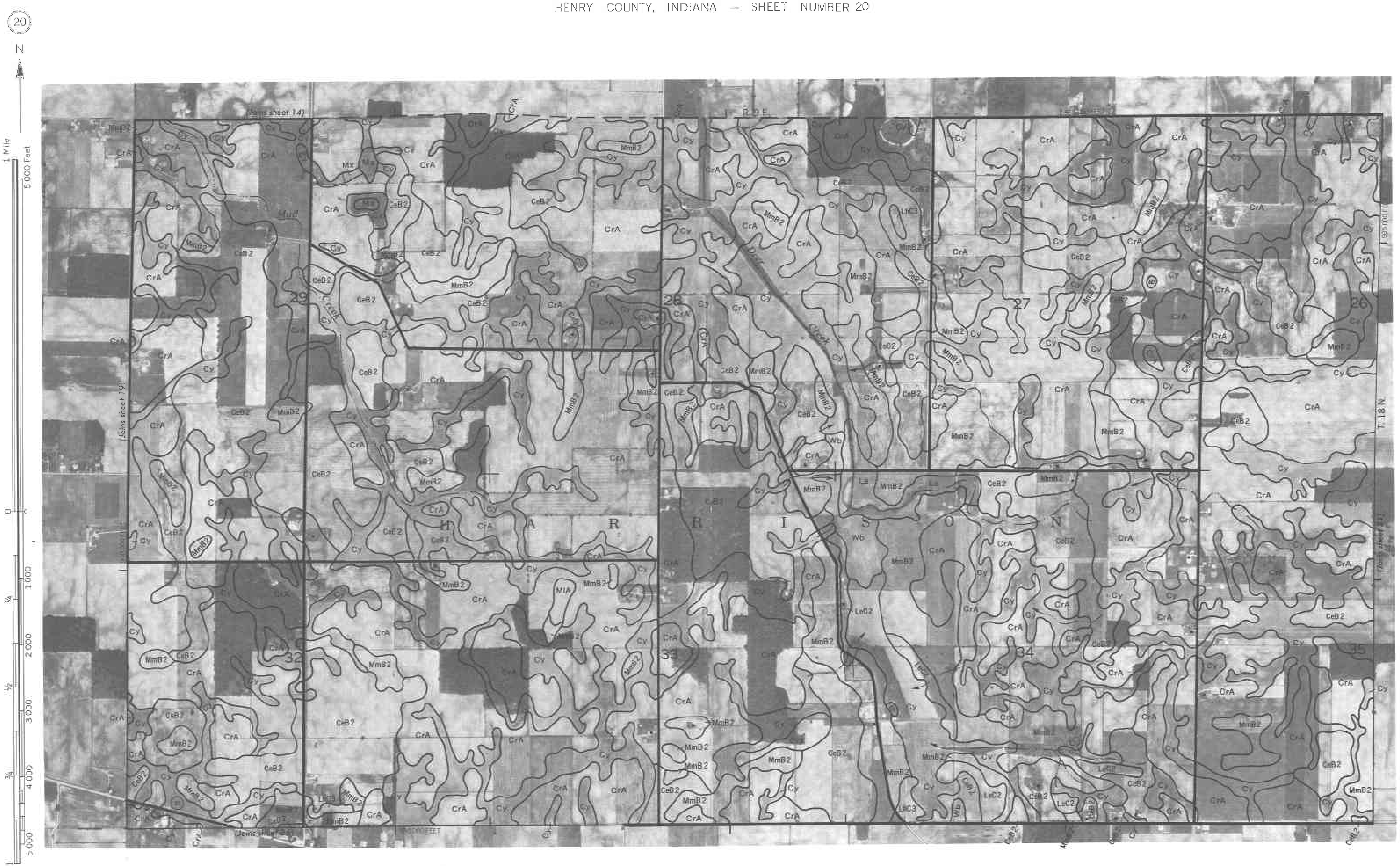



N
1 Mile
5 000 Feet
(Joins sheet 12)
(Joins sheet 17)
(Joins sheet 24)
T. R. 11 E.
R. 12 E.
18 N.
RANDOLPH COUNTY
WAYNE COUNTY
Mooreland
BLUE RIVER
Flatrock
Wright
Wilbur
Sn
CsA
Ts
CfB2
LsB2
MoB2
CrA
Cy
LeB2
CeB2
EdA
Wa
Sk
Mx
LhC3




HENRY COUNTY, INDIANA NO. 19

This map is compiled on 19__ aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

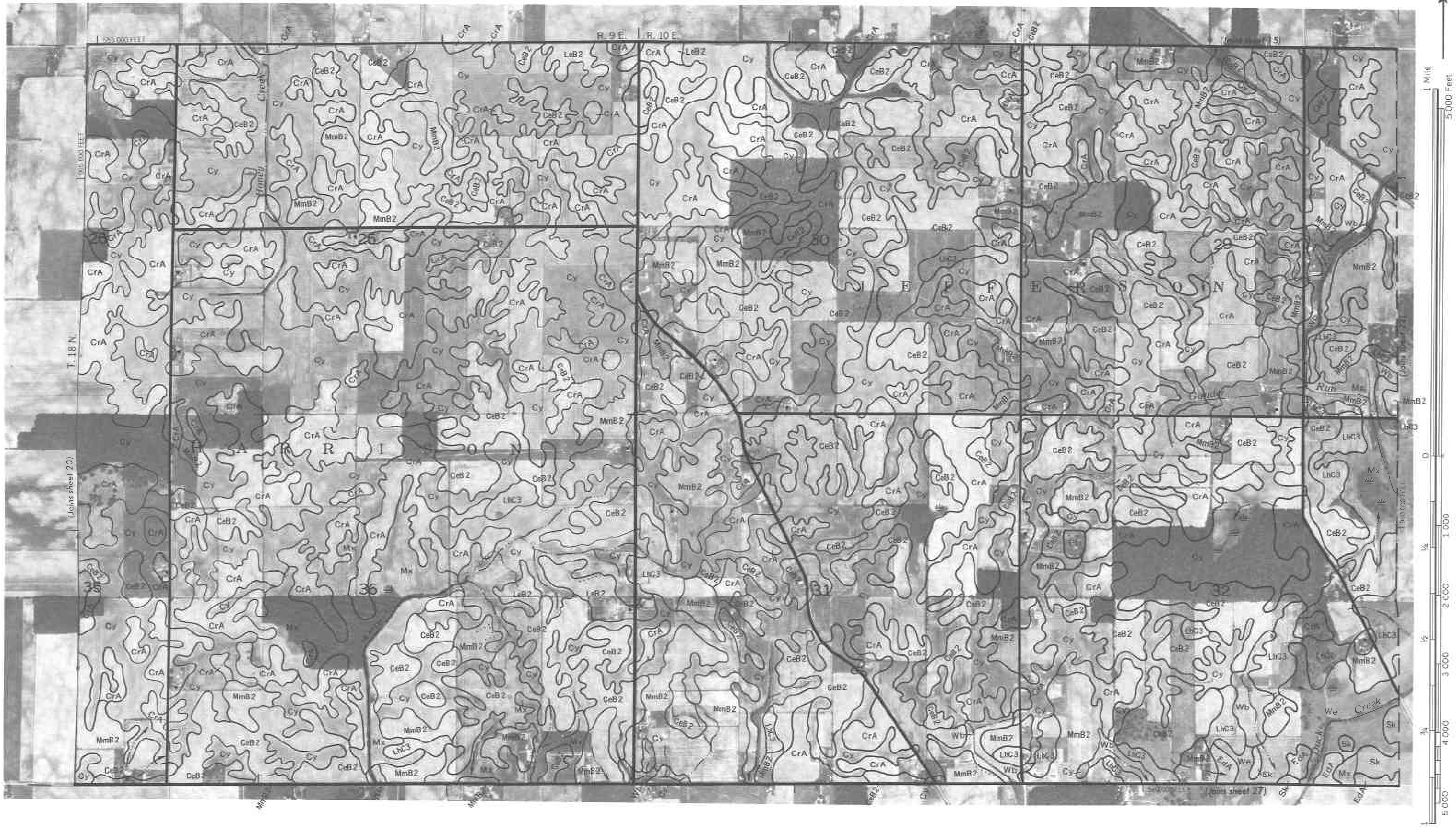



This map is compiled on [illegible] aerial photographs by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HENRY COUNTY, INDIANA NO. 20

HENRY COUNTY, INDIANA NO. 21

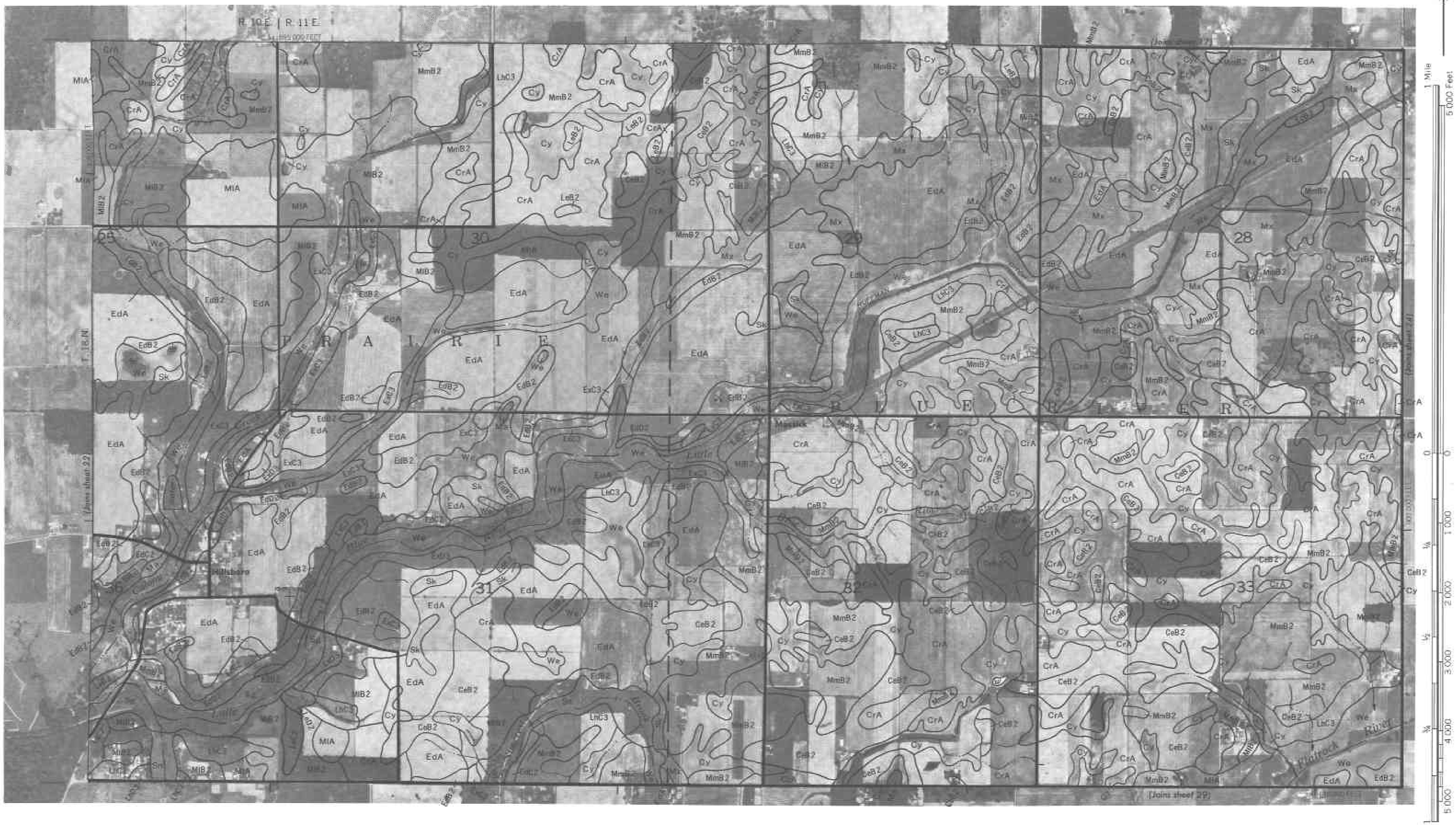
This map is compiled on 1971 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.




N
1 Mile
5 000 Feet
(Joins sheet 16)
R. 10 E.
(Joins sheet 21)
(Joins sheet 23)
(Joins sheet 28)
T. 18 N.
P R A I R I E
Lick Branch
Big Blue River
Little Blue River
25
26
27
28
33
34
35
36

(23)

N

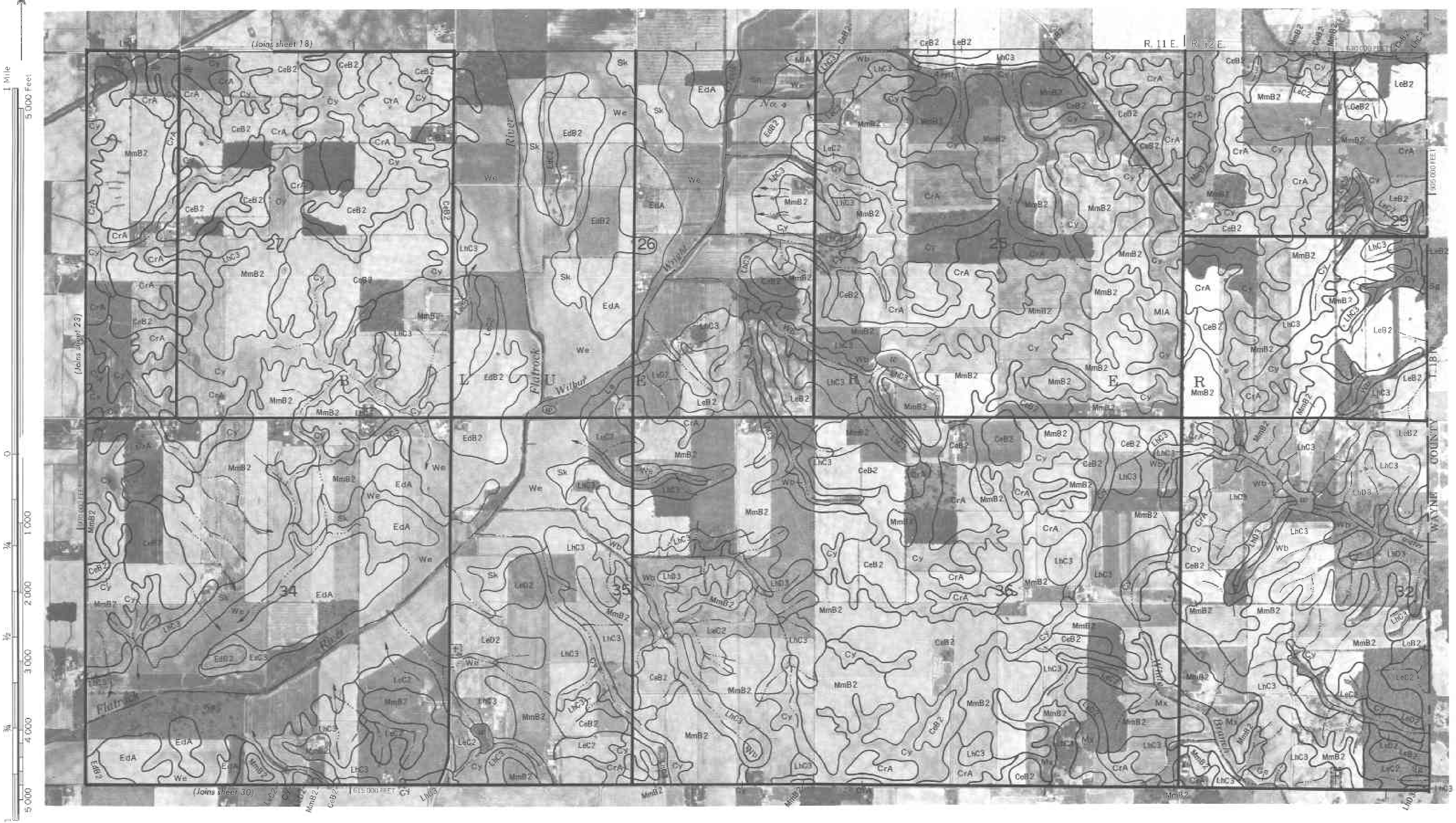



HENRY COUNTY, INDIANA NO. 23

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

24

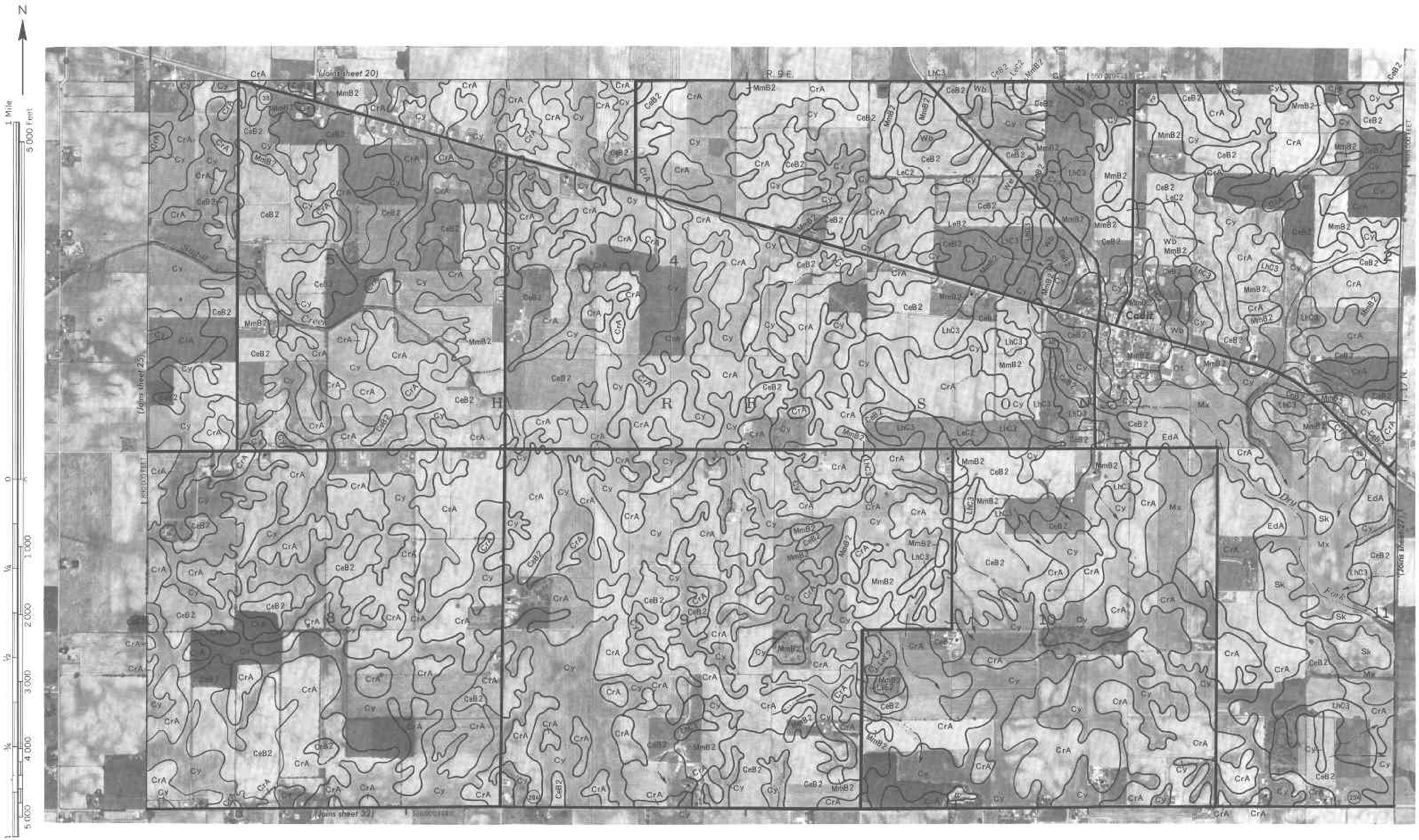
N



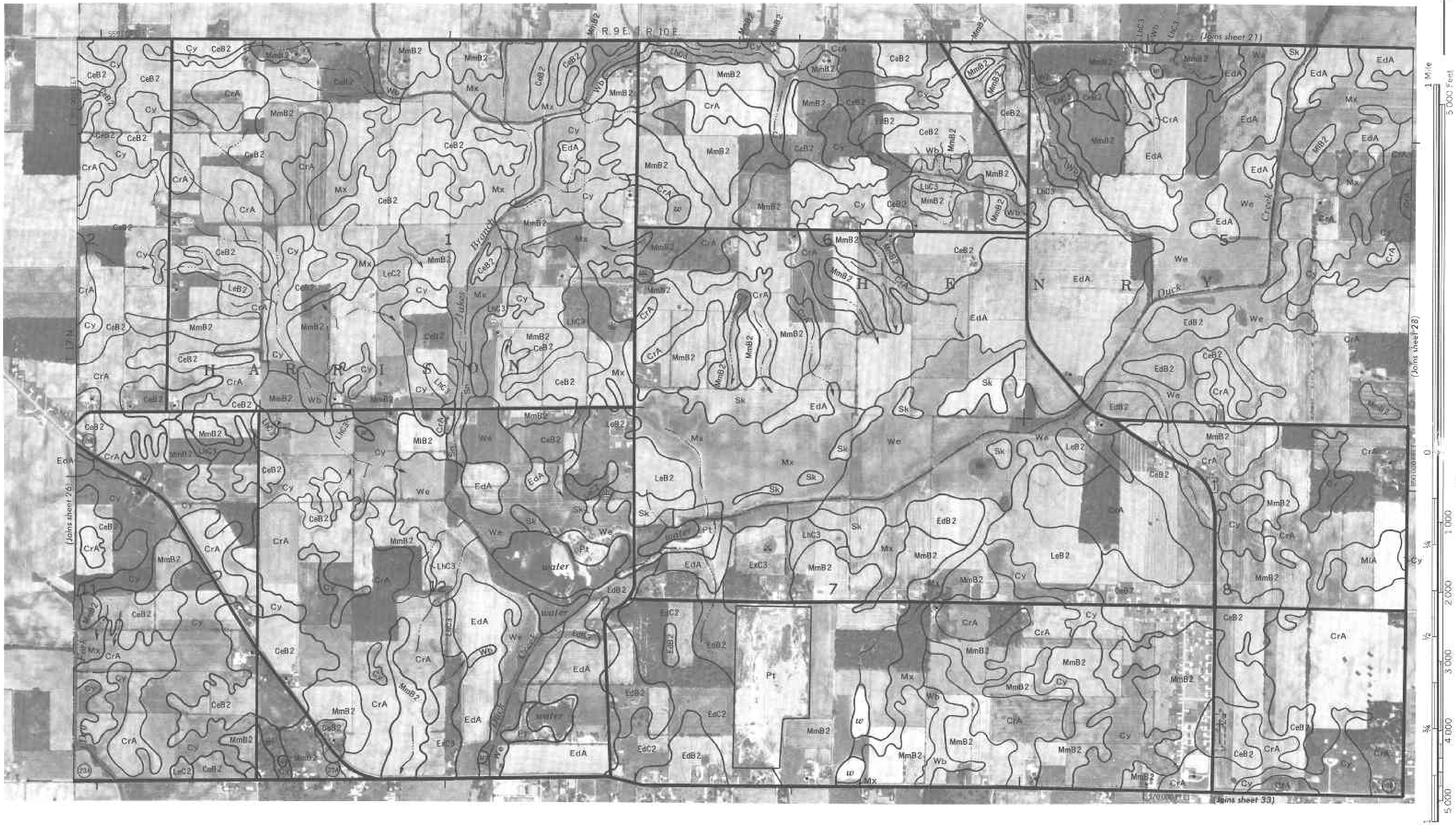

HENRY COUNTY, INDIANA NO. 24


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

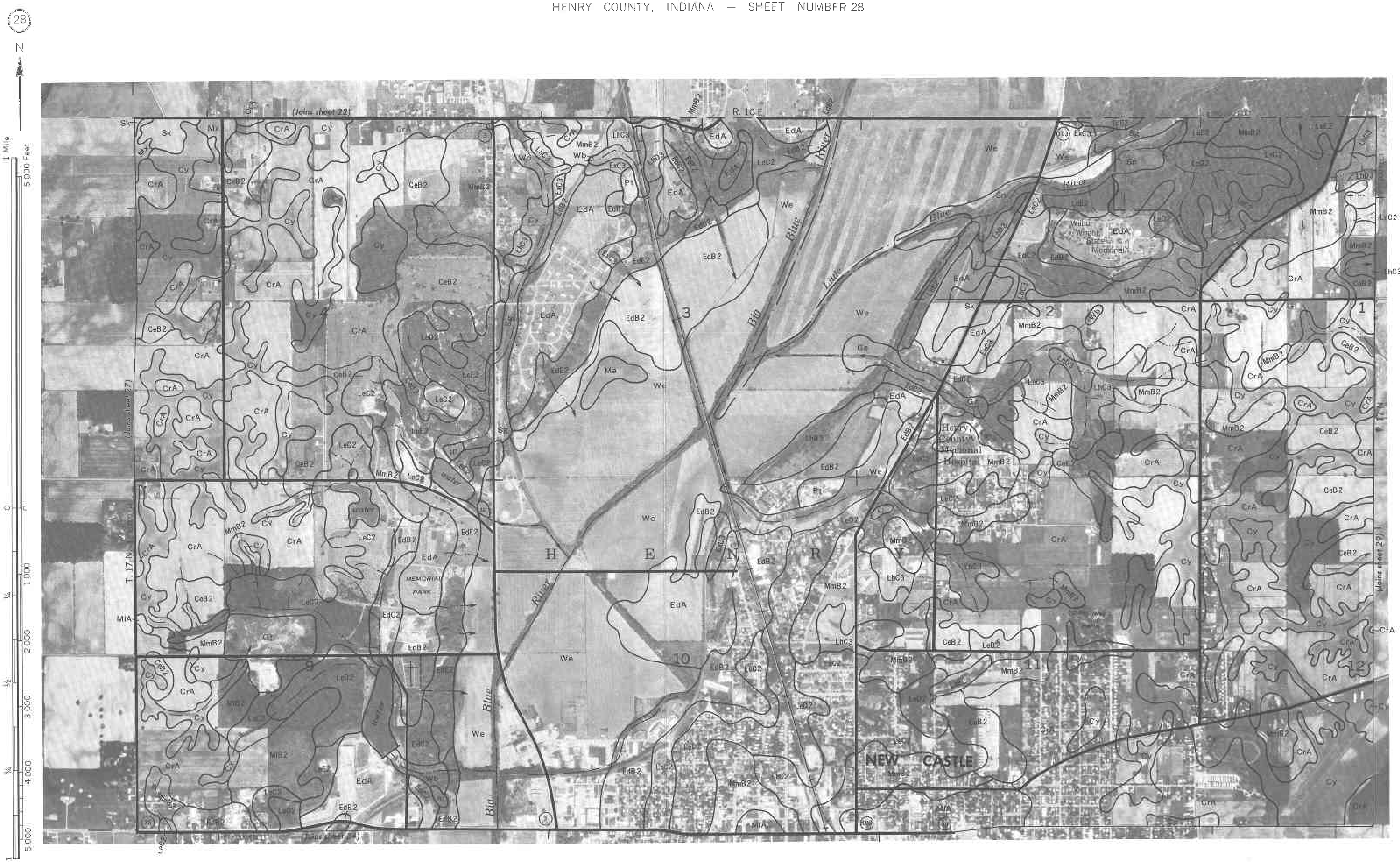
HENRY COUNTY, INDIANA — SHEET NUMBER 26



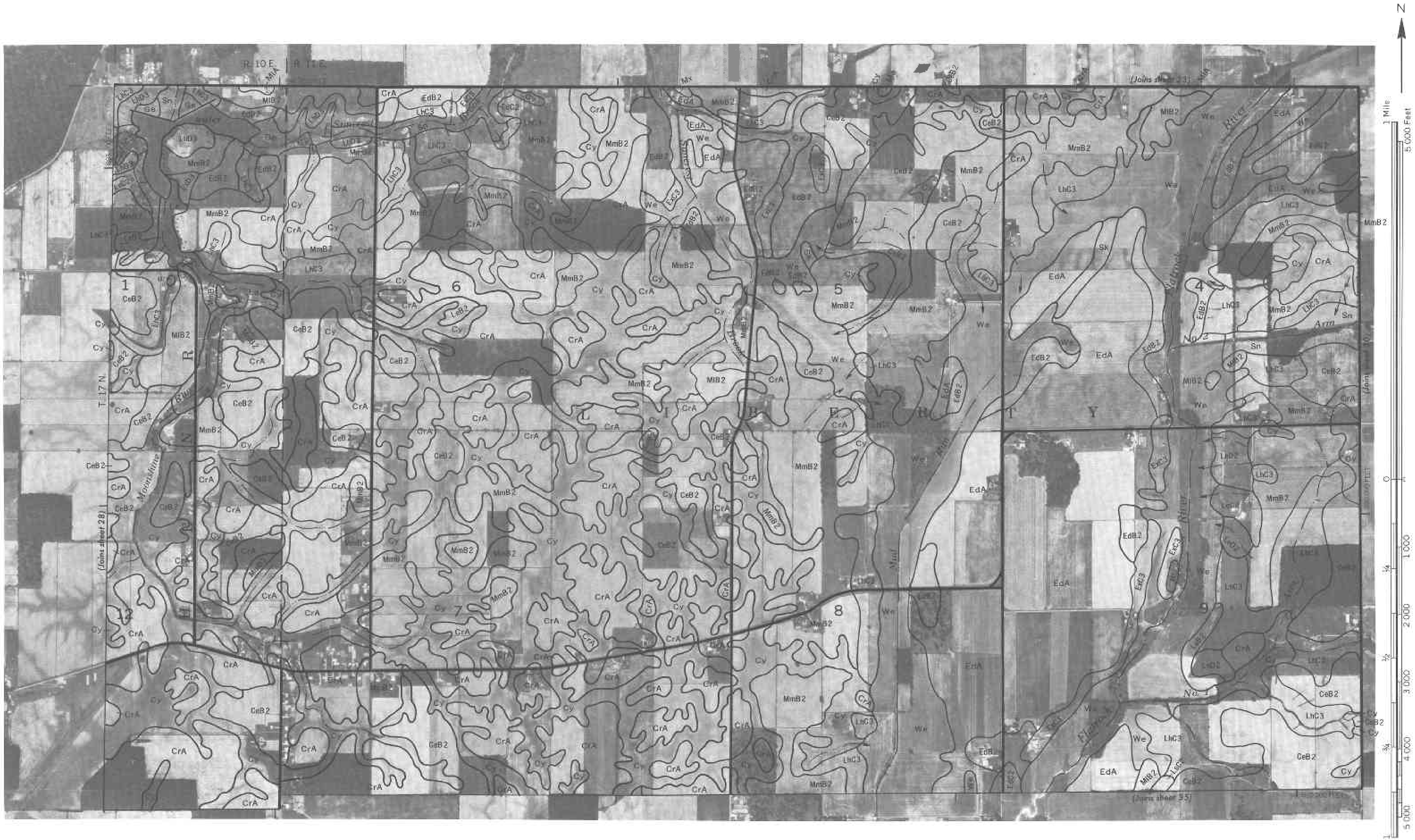
27

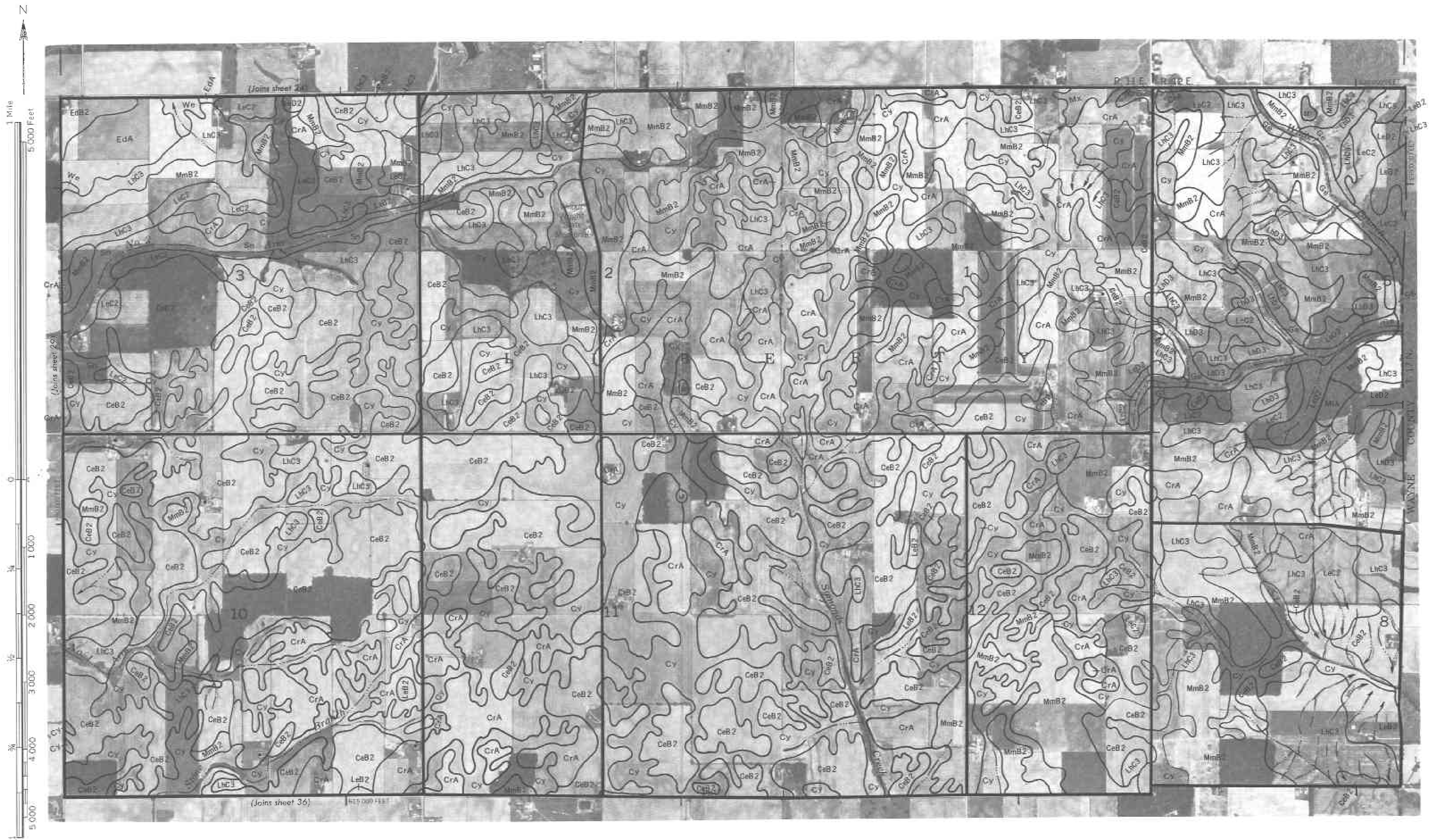


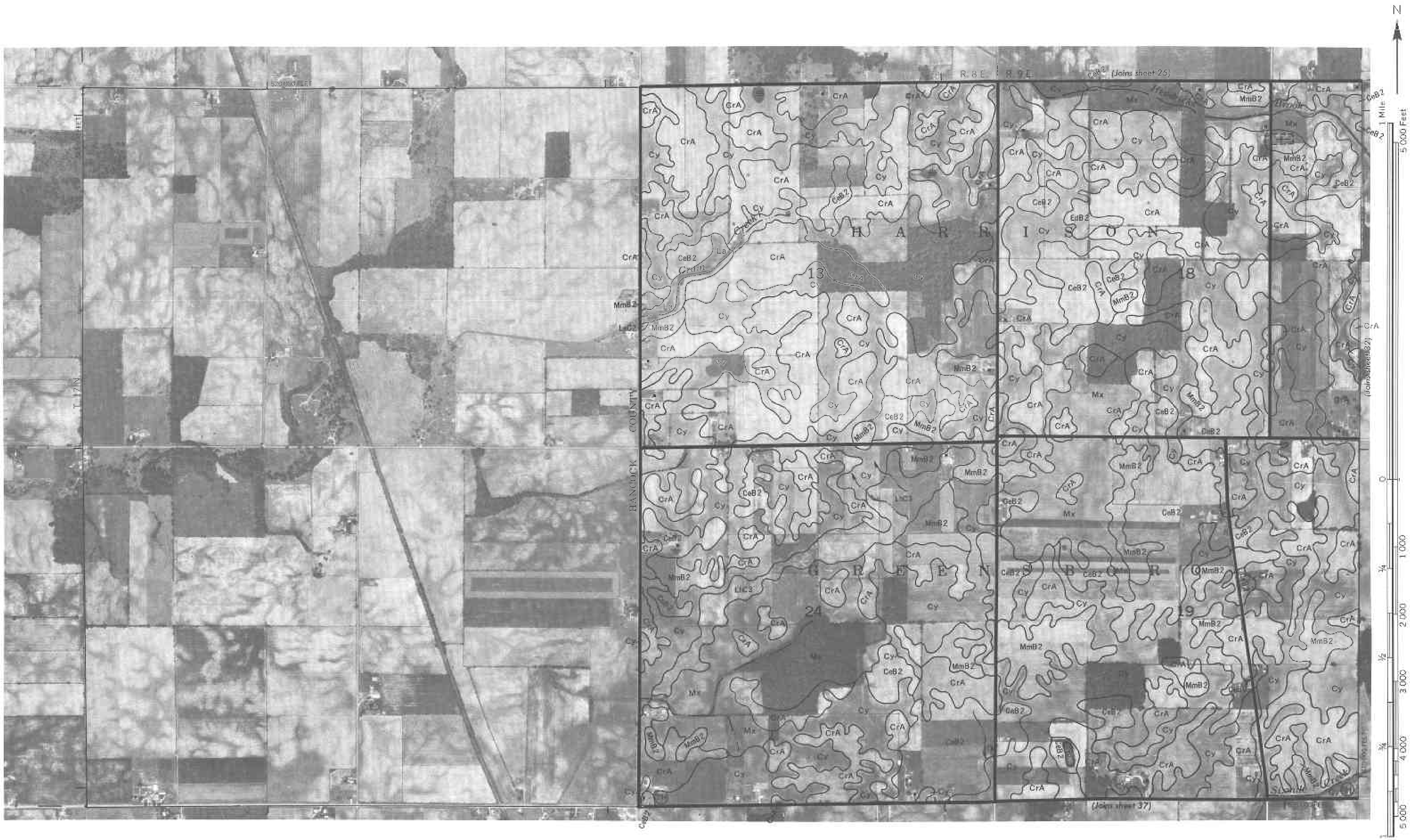
N
R.9E. R.10E.
(Joins sheet 21)
(Joins sheet 28)
(Joins sheet 33)
(Joins sheet 26)
H A R R I S O N
H E N R Y
Duck Creek
Lakes Branch
water
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000


28
N
1 Mile
5 000 Feet
(Joins sheet 22)
(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 34)
R. 10 E.
T. 17 N.
H E N R Y
NEW CASTLE
MEMORIAL PARK
Henry County Memorial Hospital
Wilbur Wright State Memorial
Big Blue River
Little Blue River

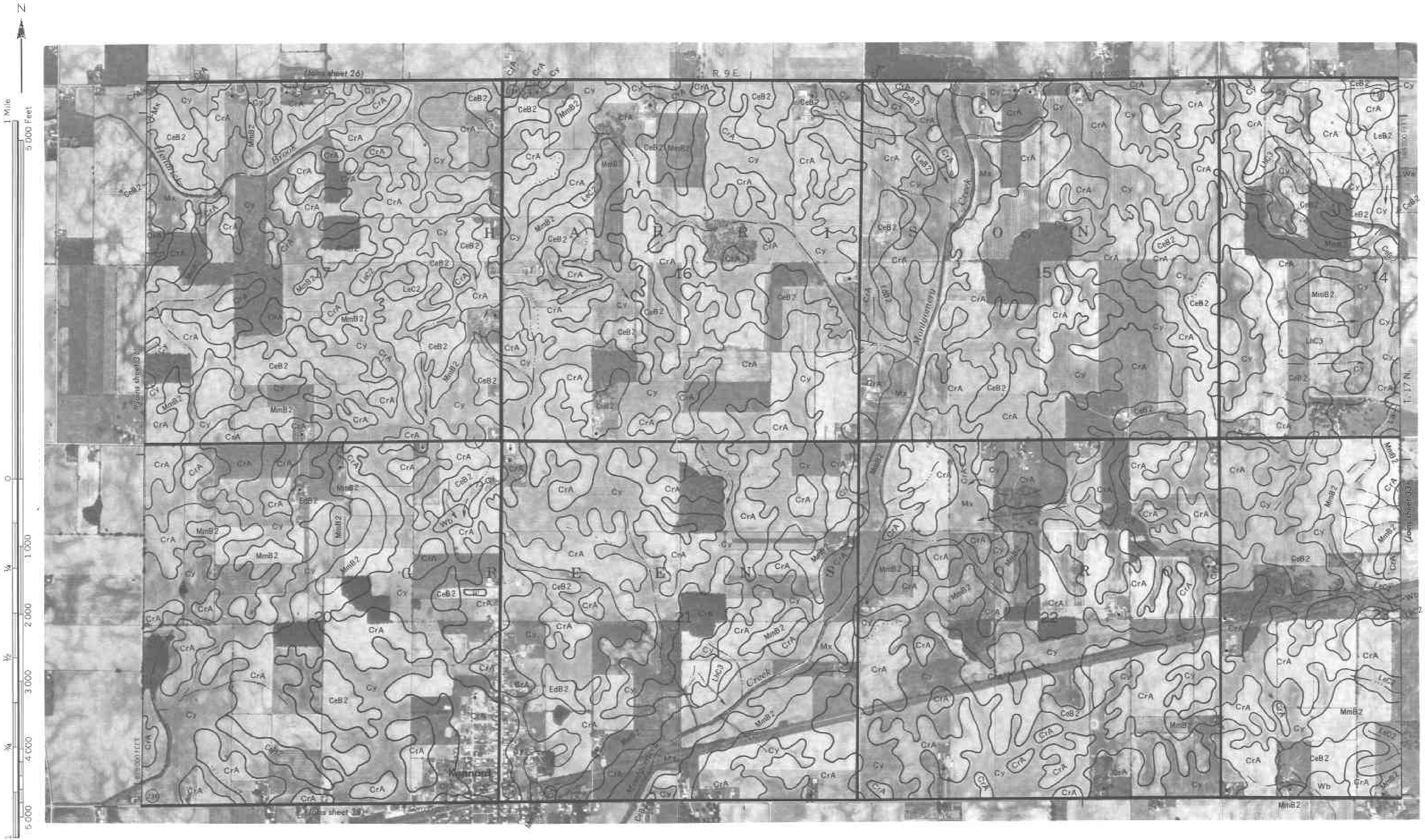
29

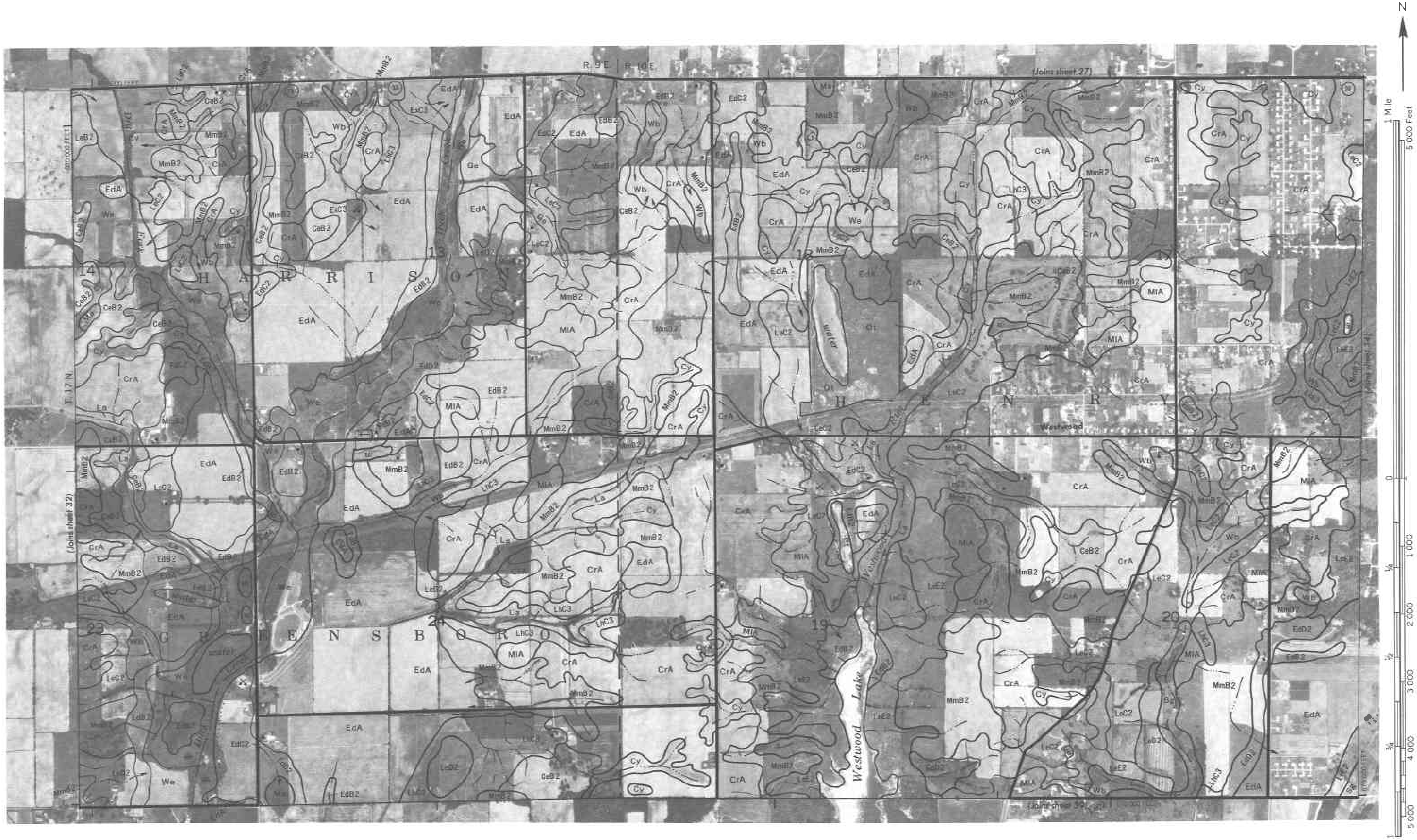

N
R 10 E
R 11 E
T 17 N
(Joins sheet 23)
(Joins sheet 28)
(Joins sheet 35)
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000
1
4
5
6
7
8
9
12
Mud
Moonshine
Flatrock
River
No. 1
No. 2
Arm


N
1 Mile
5 000 Feet
(Joins sheet 24)
(Joins sheet 29)
(Joins sheet 36)
WAYNE COUNTY
L I B E R T Y
1
2
3
8
10
11
12
EdA
We
CrA
Cy
CeB2
MmB2
LhC3
LeC2
LeB2




This map is compiled on 1975 aerial photographs by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

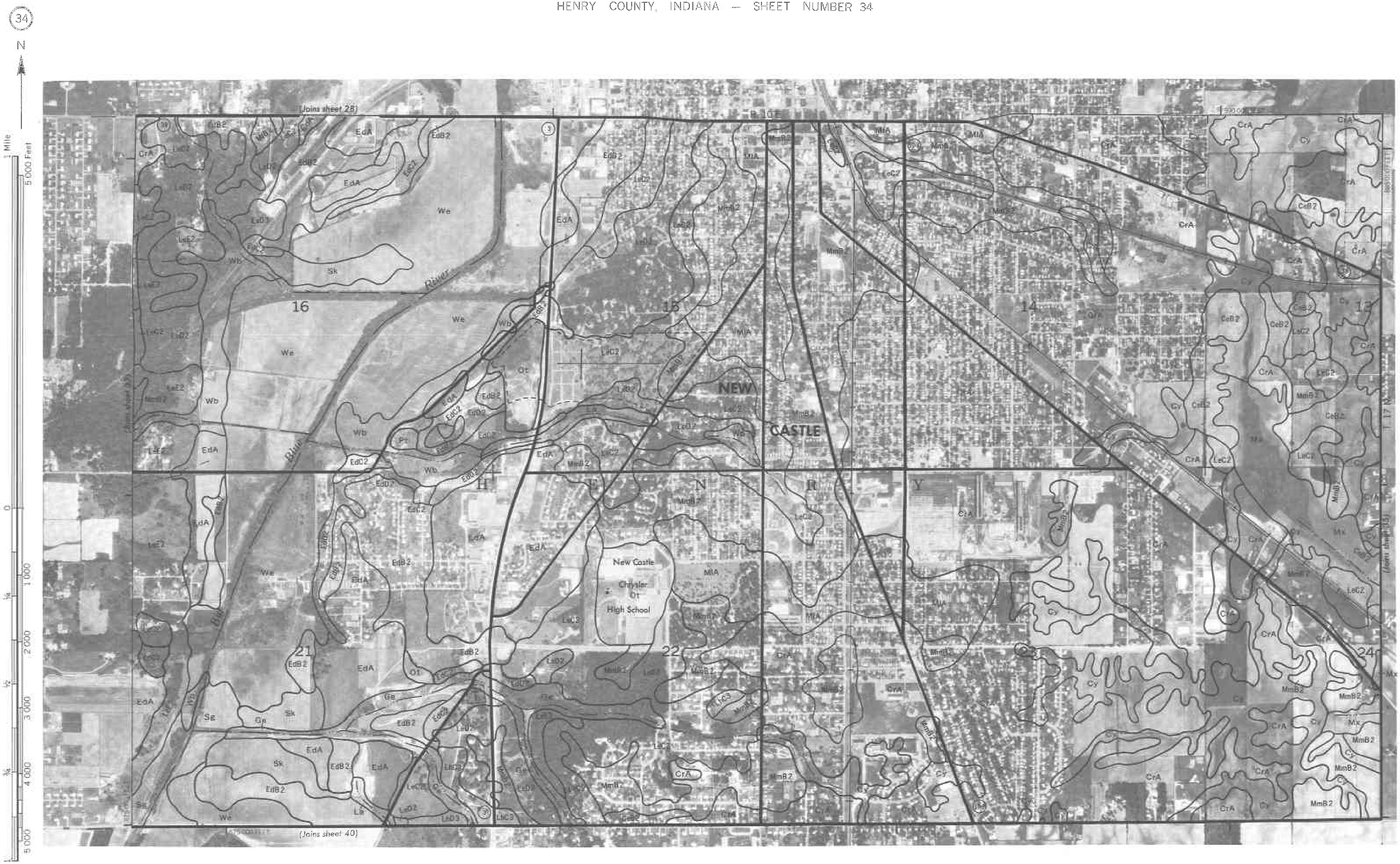

N
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
(Joins sheet 26)
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 38)
R 9 E.
T. 17 N.
H A R R I S O N
G R E E N
16
15
14
21
22
Montgomery
Creek
Kennard



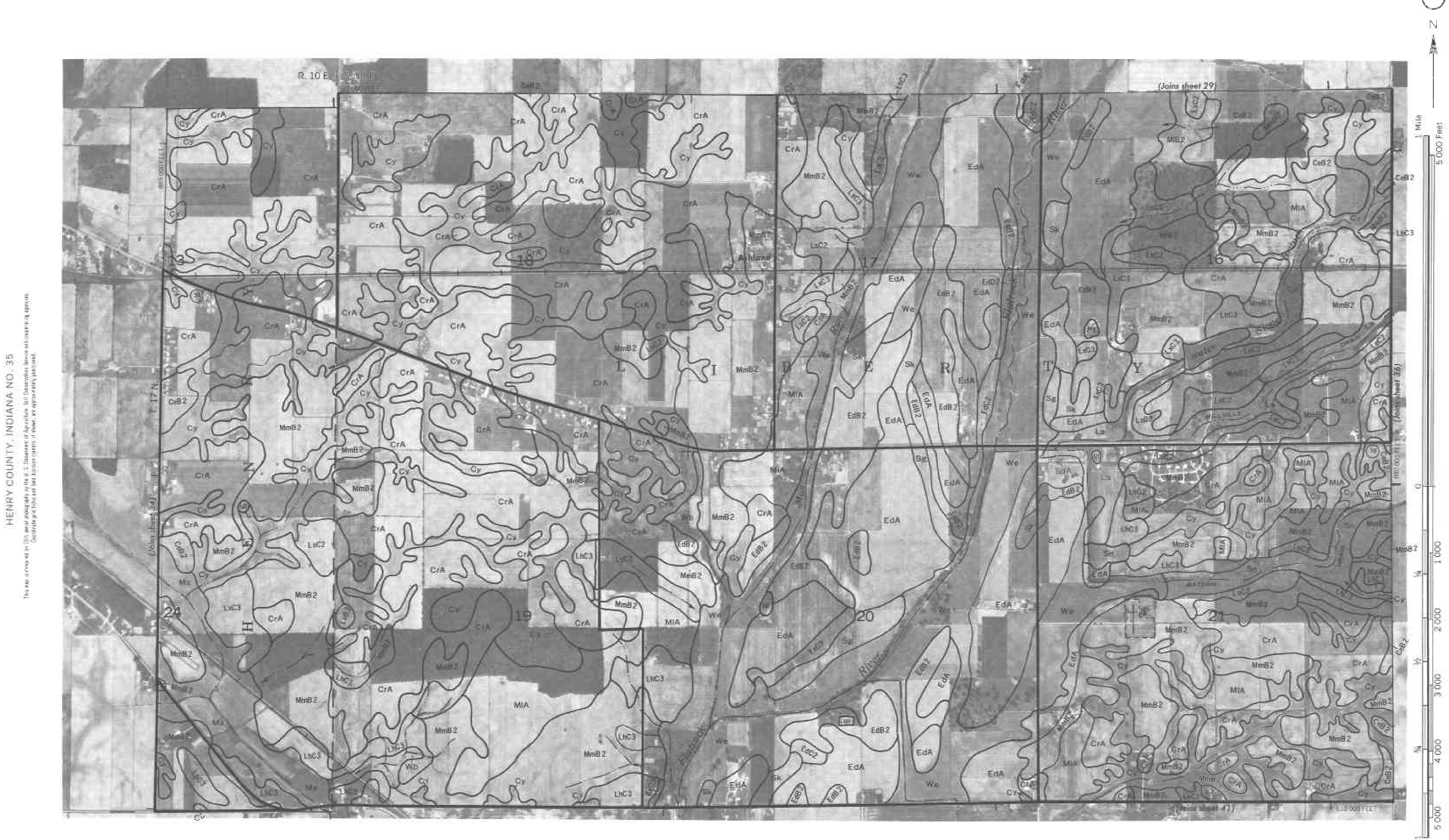

HENRY COUNTY, INDIANA NO. 33

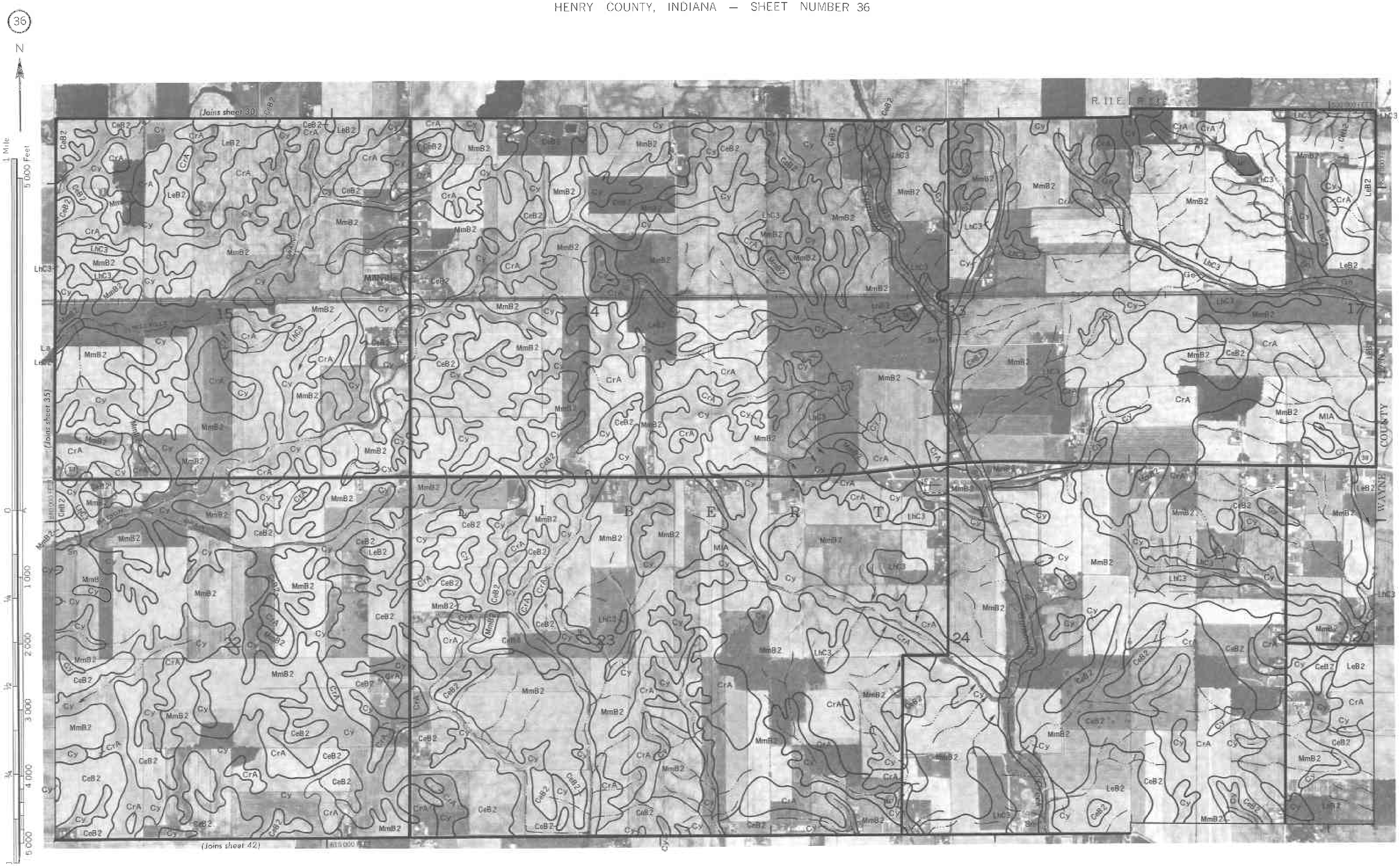
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HENRY COUNTY, INDIANA — SHEET NUMBER 34



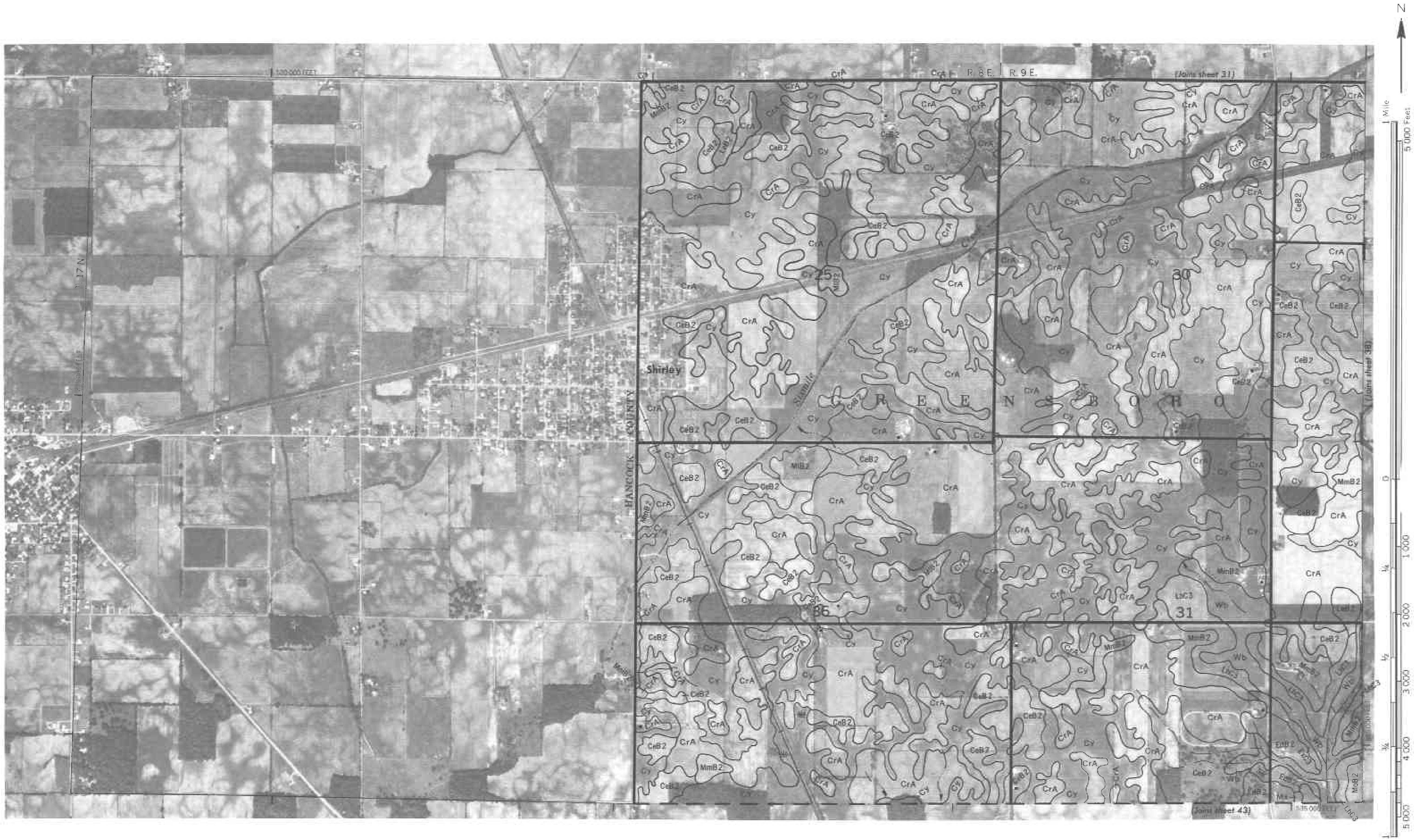

HENRY COUNTY, INDIANA NO. 34

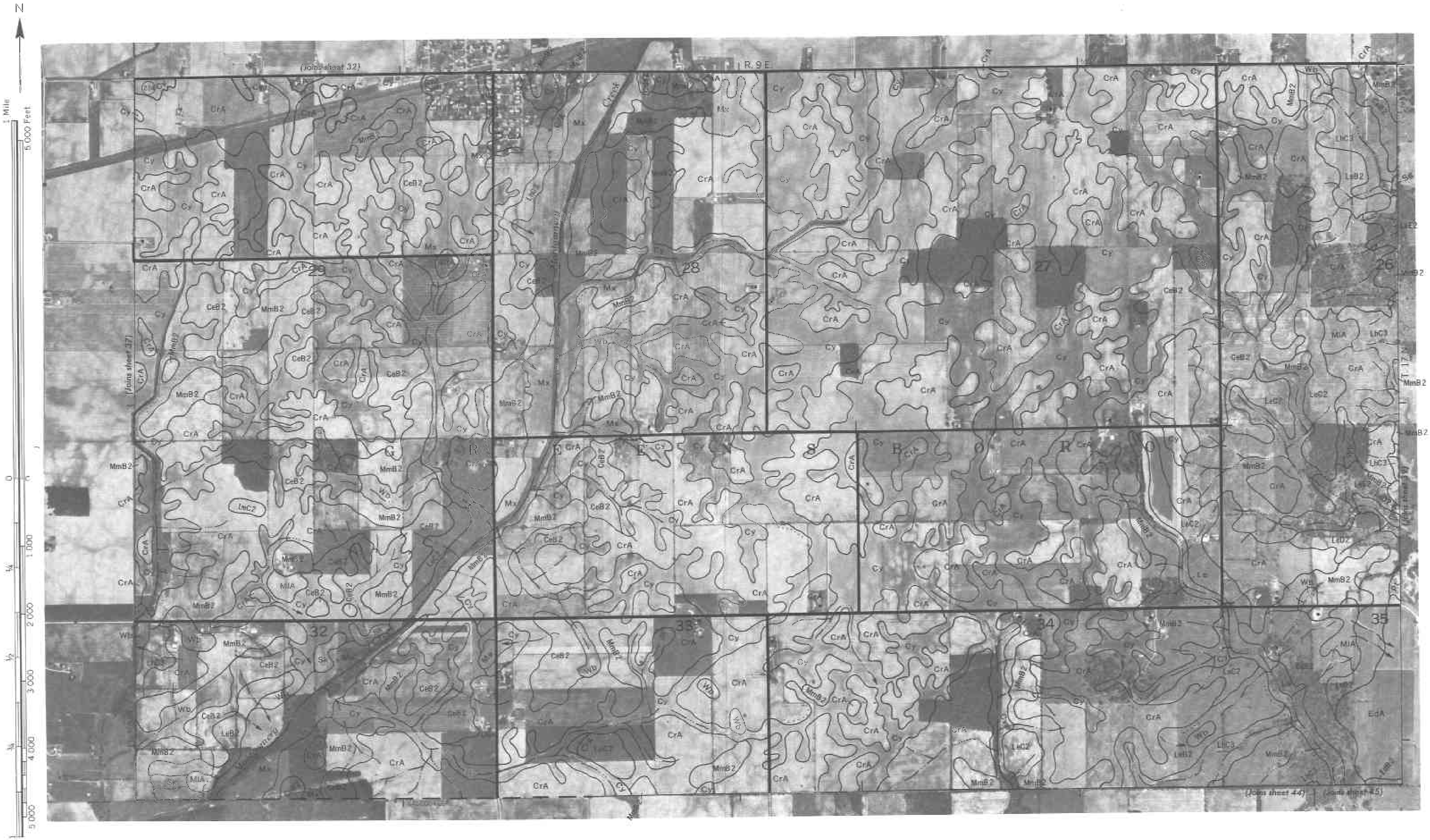

35
N
(Joins sheet 29)
(Joins sheet 36)
(Joins sheet 47)
(Joins sheet 34)
R. 10 E.
T. 17 N.
Ashland
L I B E R T Y
1 Mile
5 000 Feet
0
1000
2000
3000
4000
5000
HENRY COUNTY, INDIANA NO. 35




HENRY COUNTY, INDIANA NO. 36

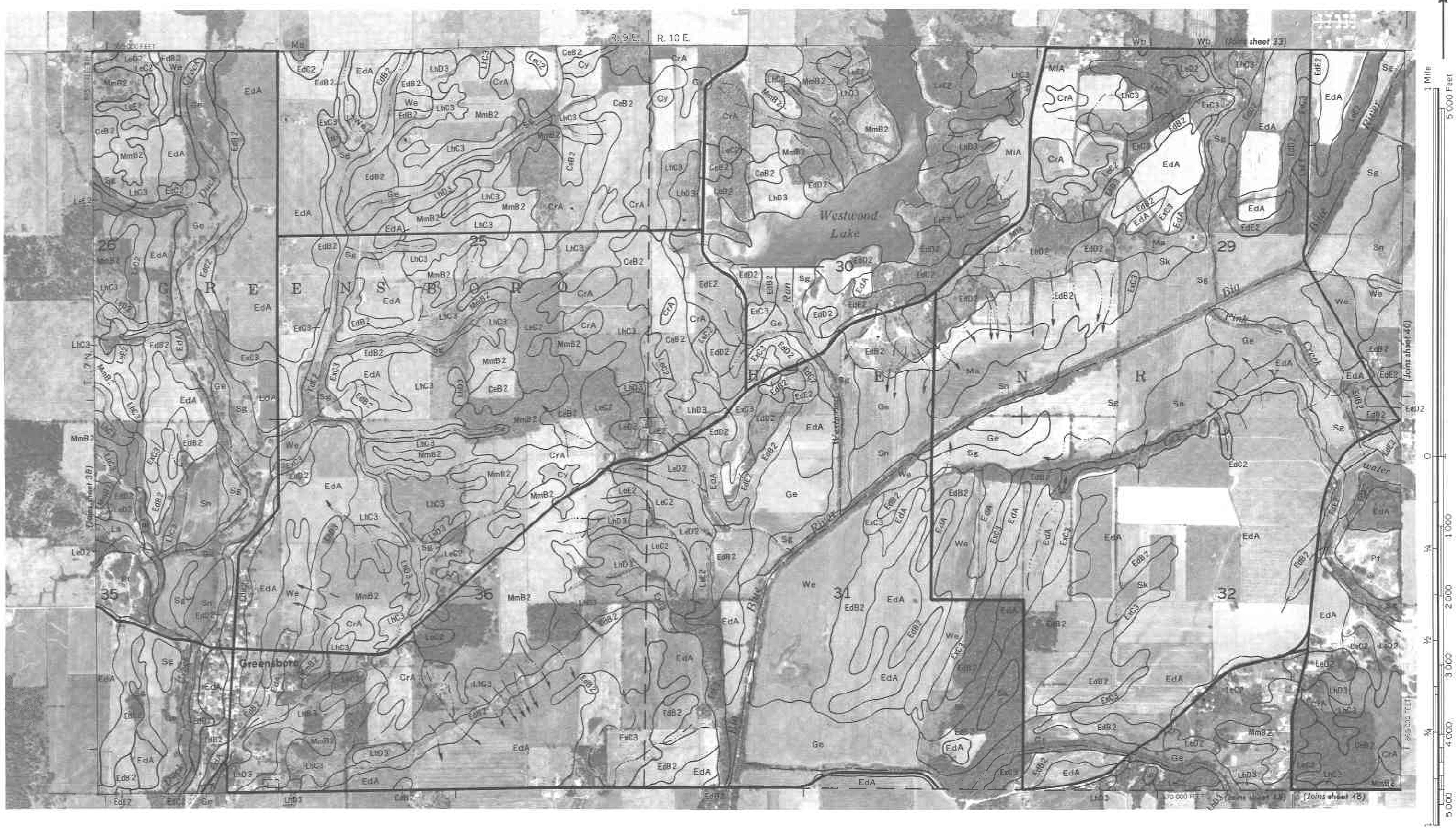
HENRY COUNTY, INDIANA NO. 37



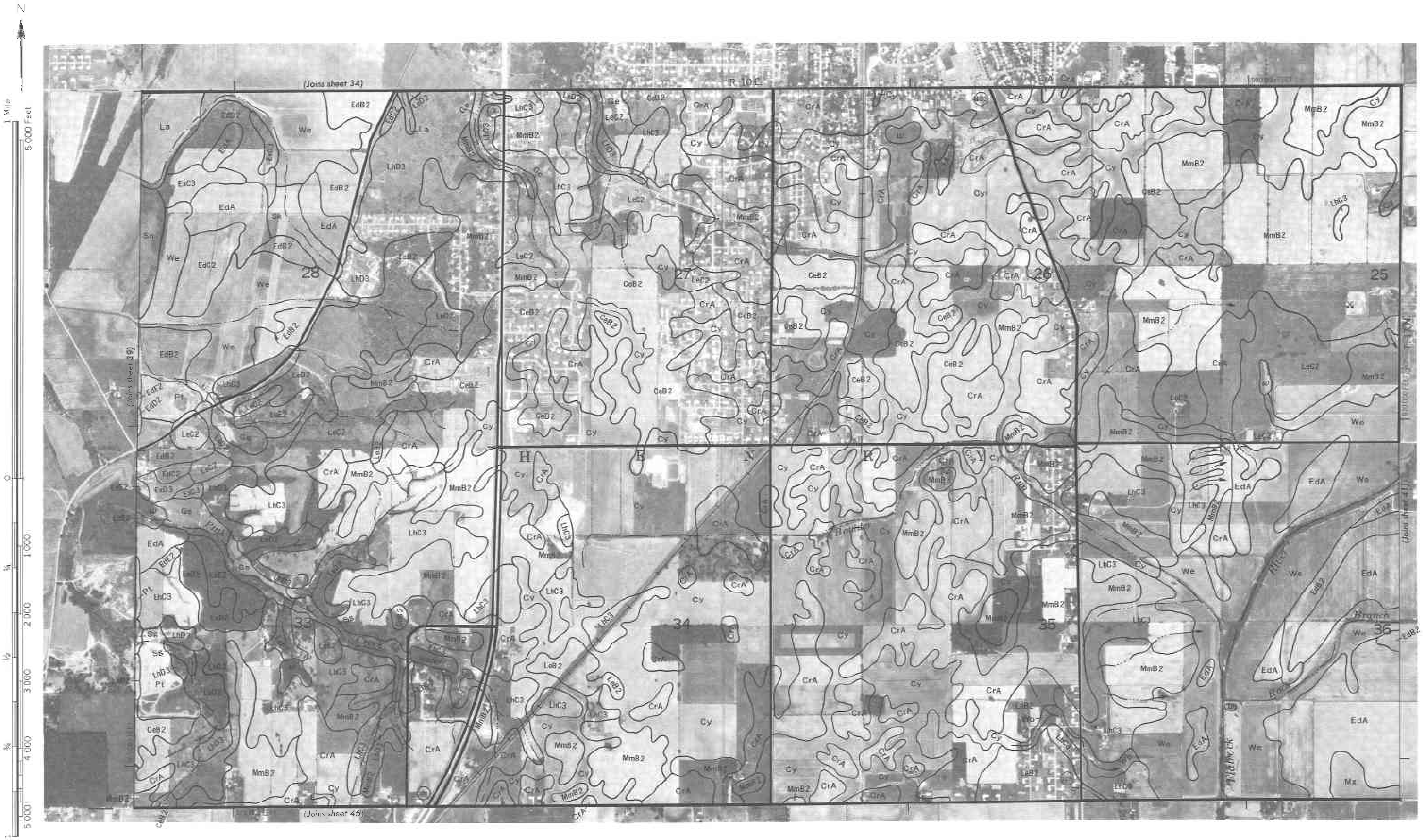


38
N
1 Mile
5 000 Feet
(Joins sheet 32)
R. 9 E.
(Joins sheet 37)
(Joins sheet 44)
(Joins sheet 45)
29
28
27
26
32
33
34
35
G R E E N S B O R O
Cy
CrA
CeB2
MmB2
Mx
Wb
LbC2
LcC3
MIA
EdA

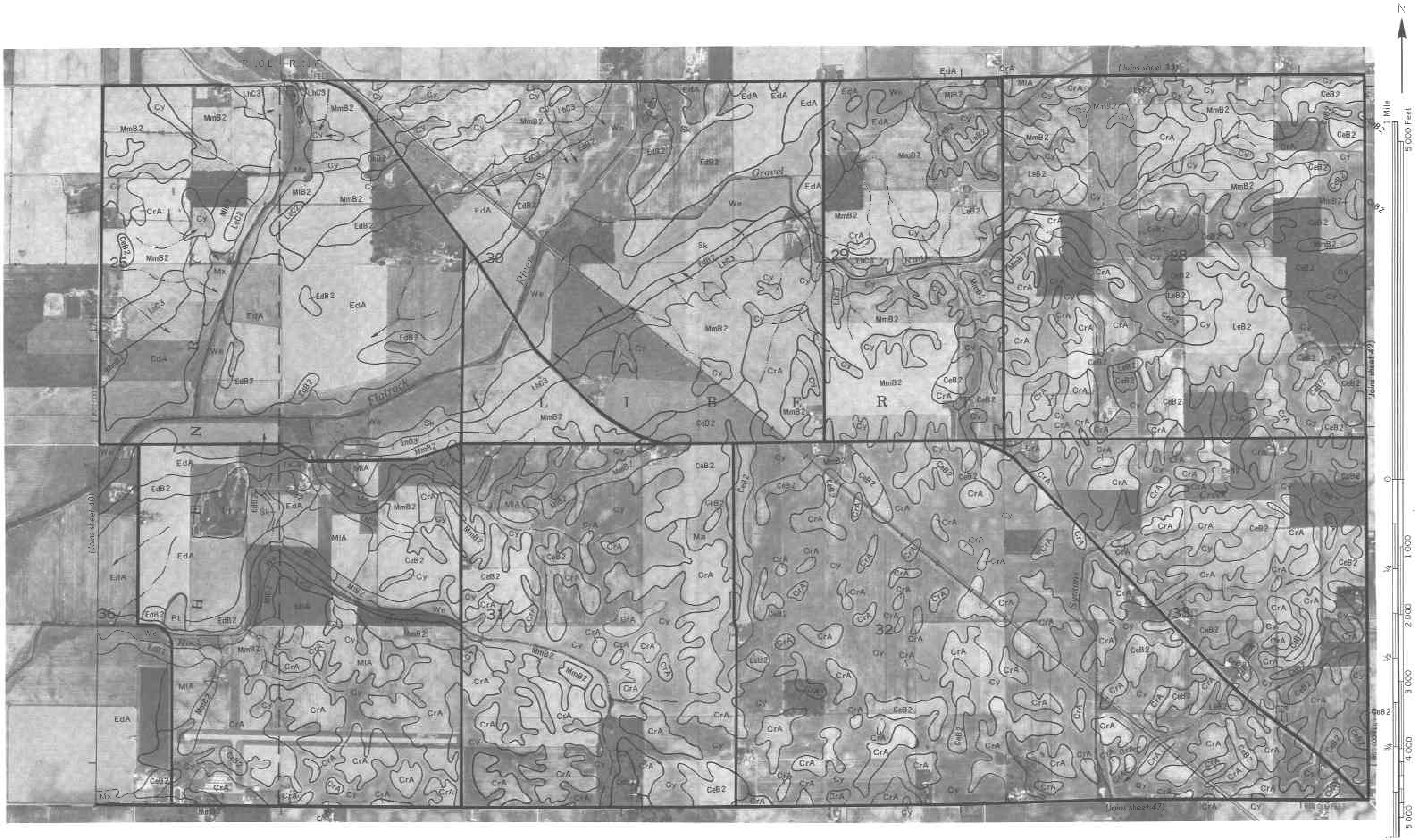
HENRY COUNTY, INDIANA NO. 39



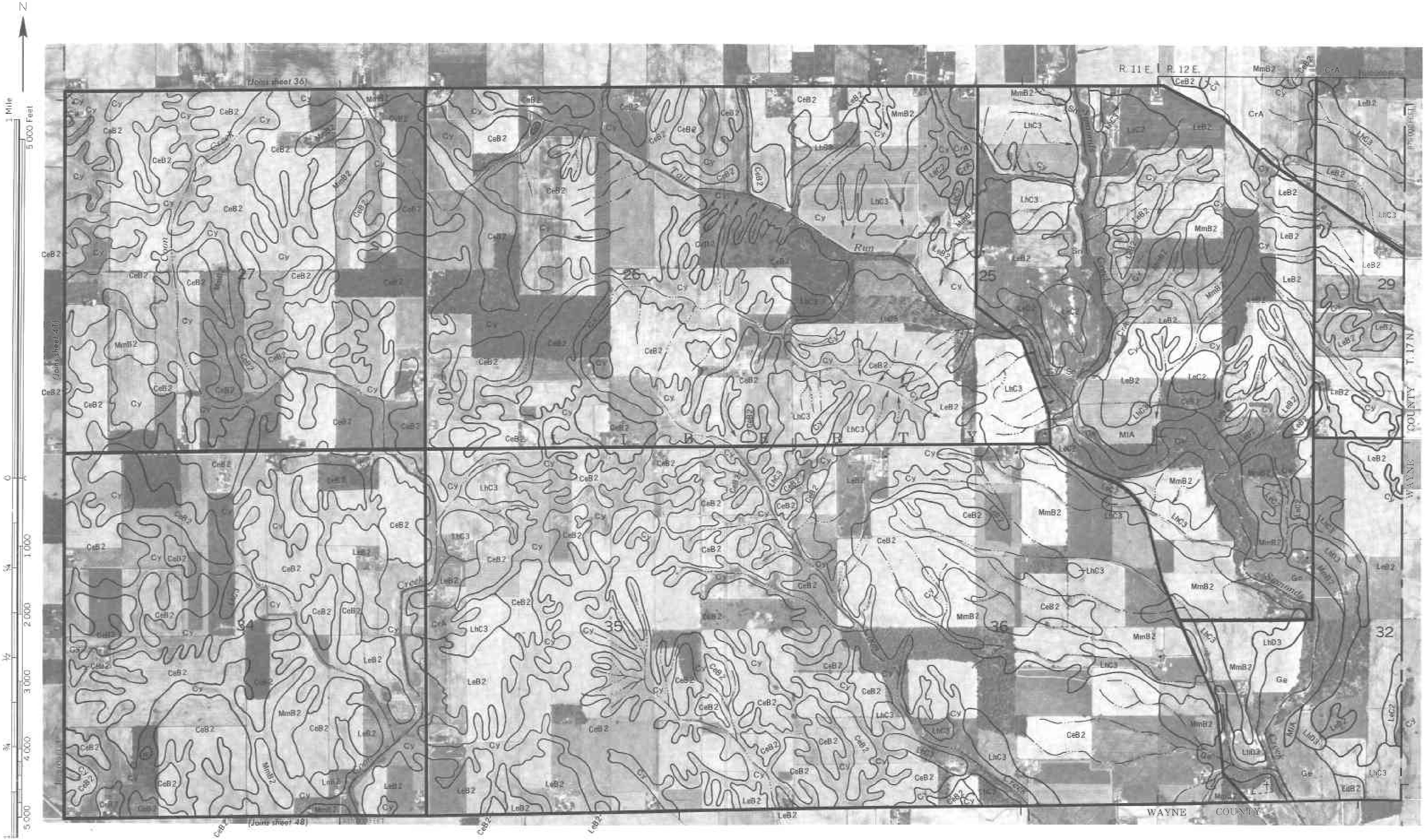
HENRY COUNTY, INDIANA — SHEET NUMBER 40




HENRY COUNTY, INDIANA NO. 40

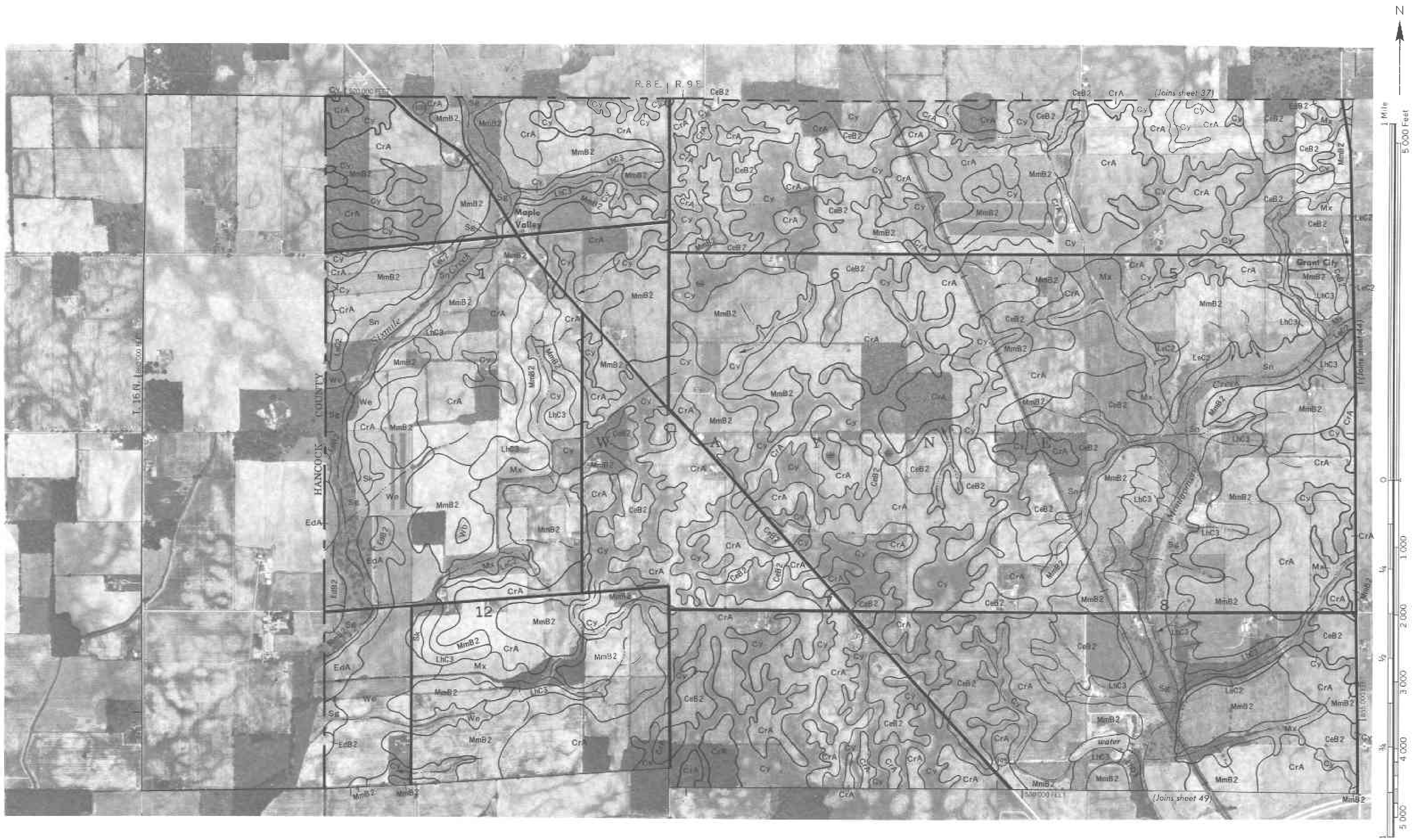



HENRY COUNTY, INDIANA NO. 41



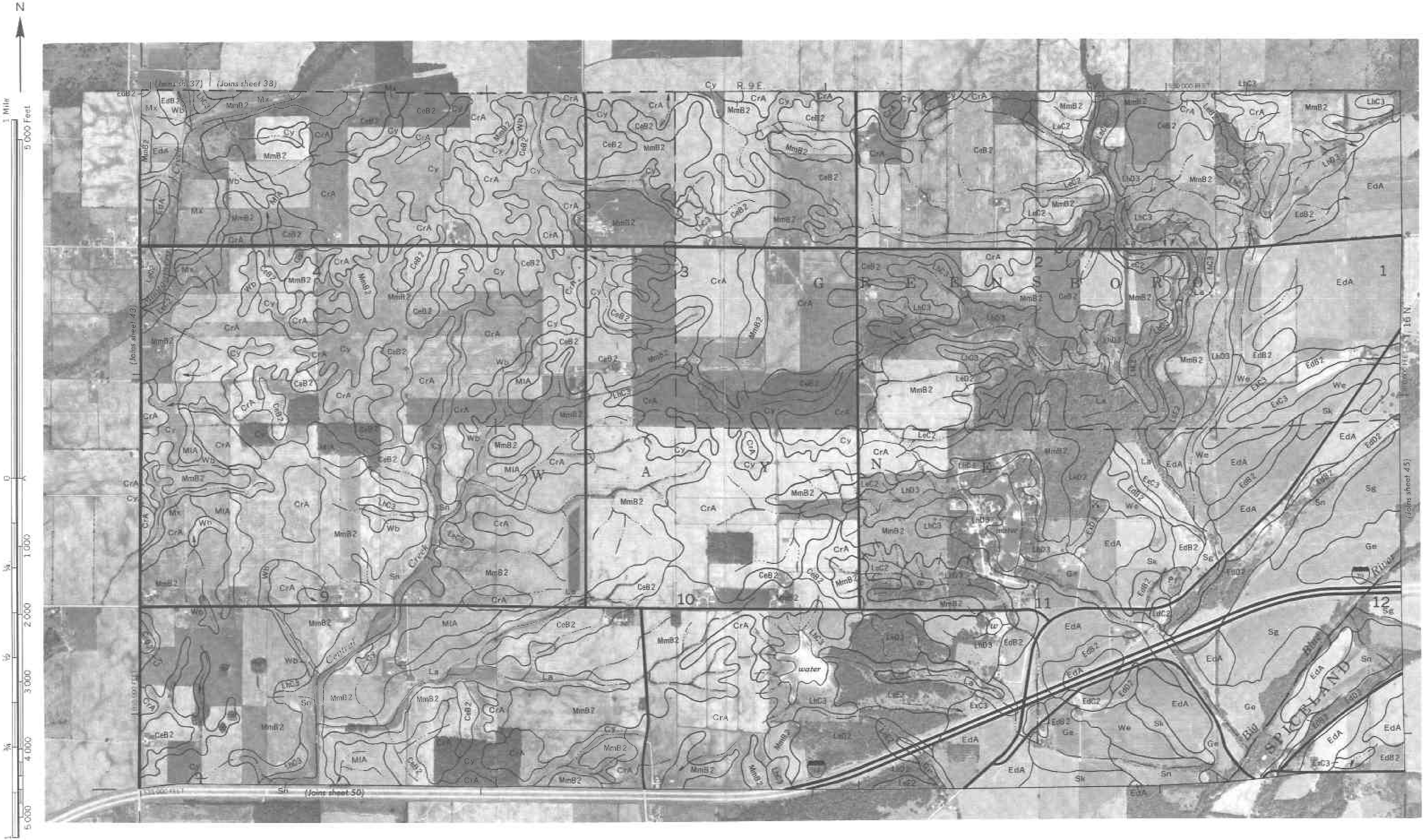

HENRY COUNTY, INDIANA NO. 42

(43)

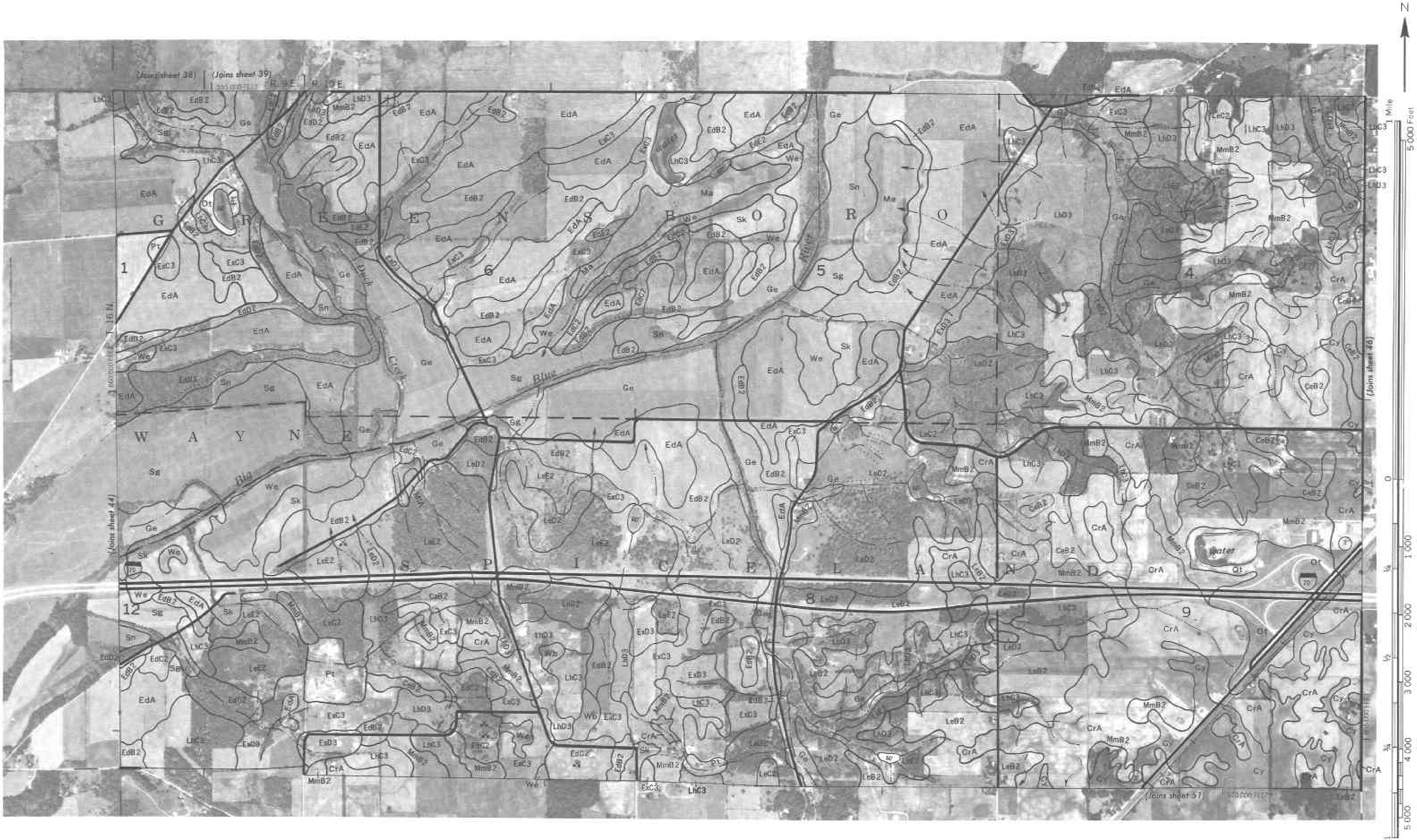


HENRY COUNTY, INDIANA NO. 43

(44)

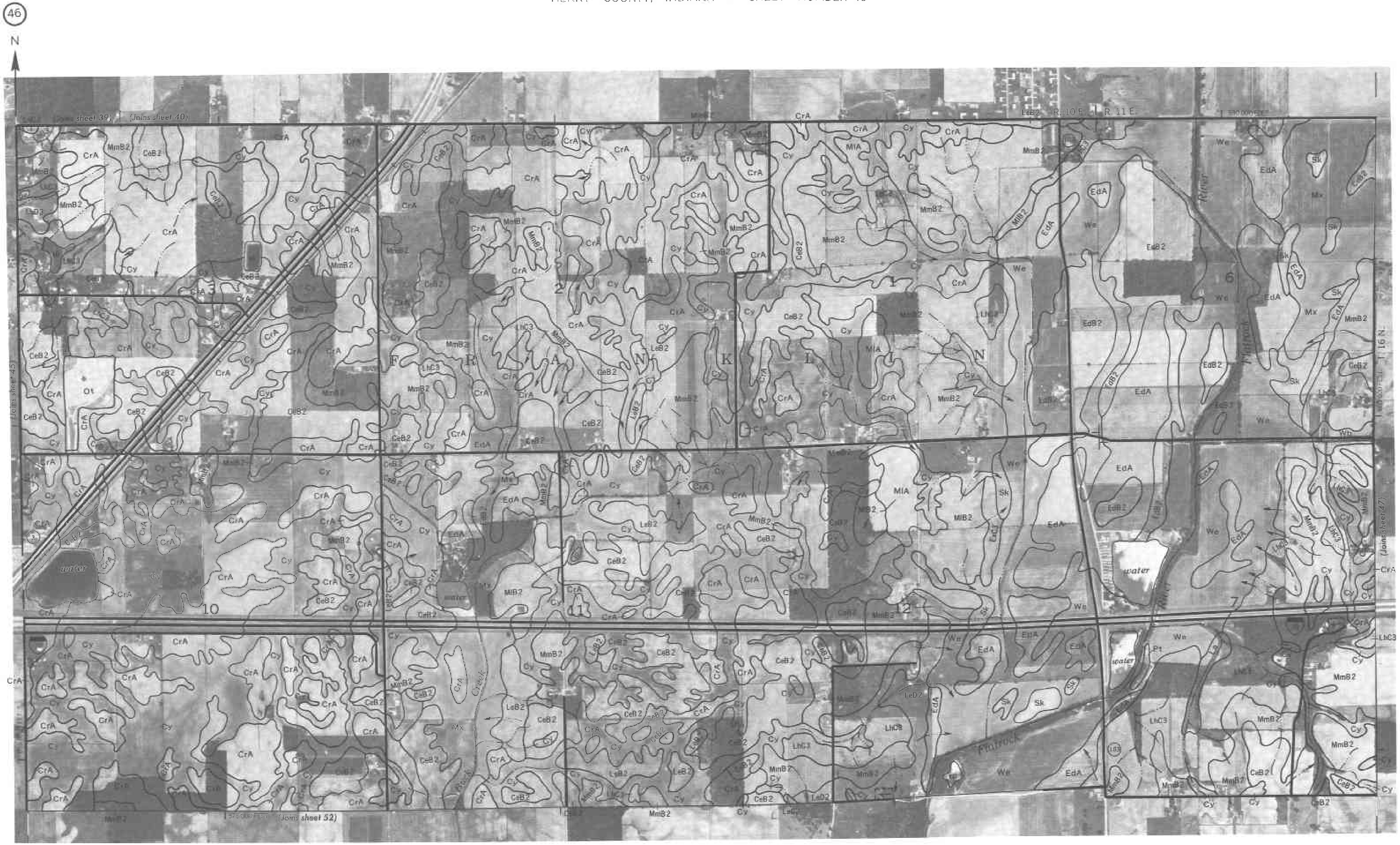



HENRY COUNTY, INDIANA NO. 44




HENRY COUNTY, INDIANA NO. 45

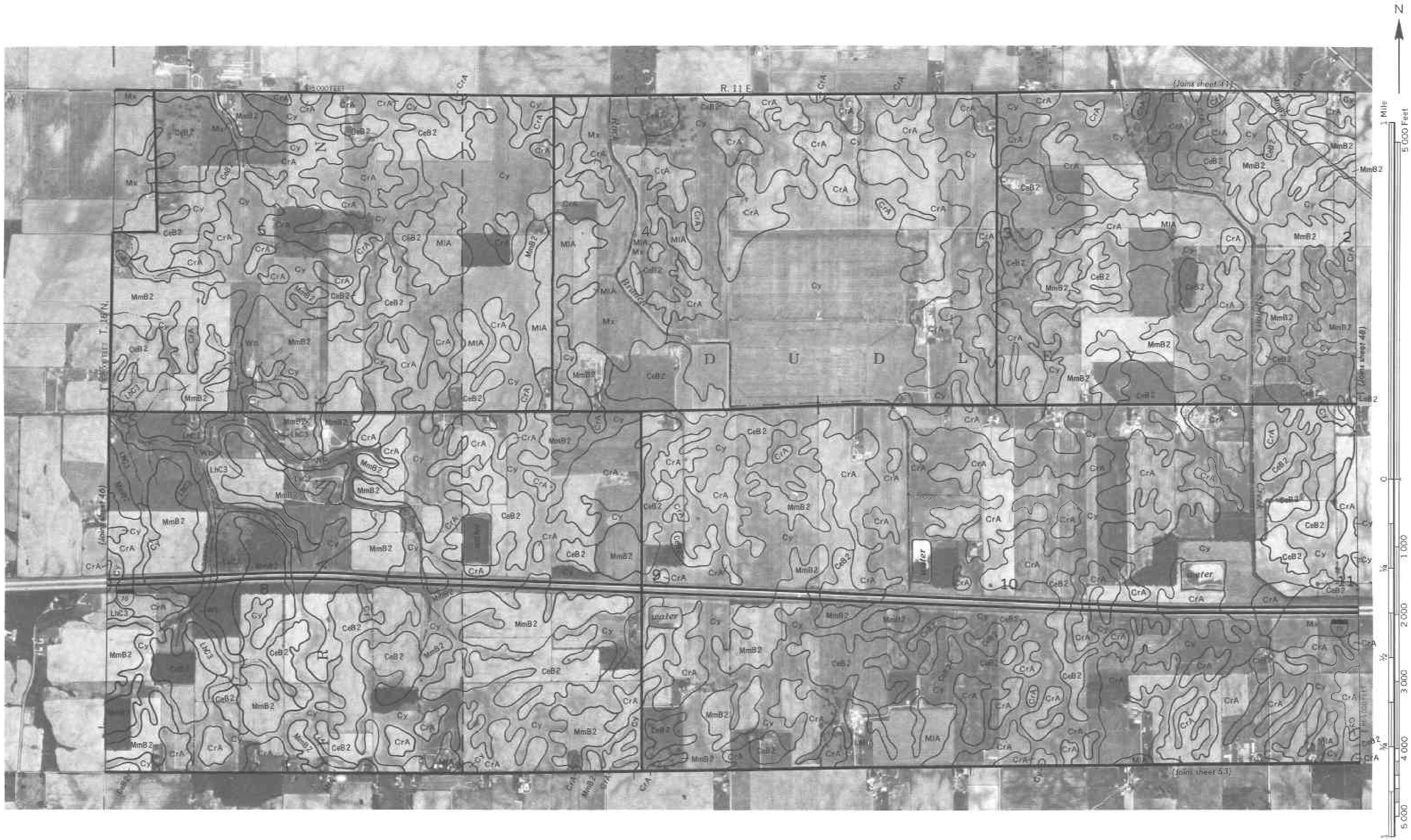
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



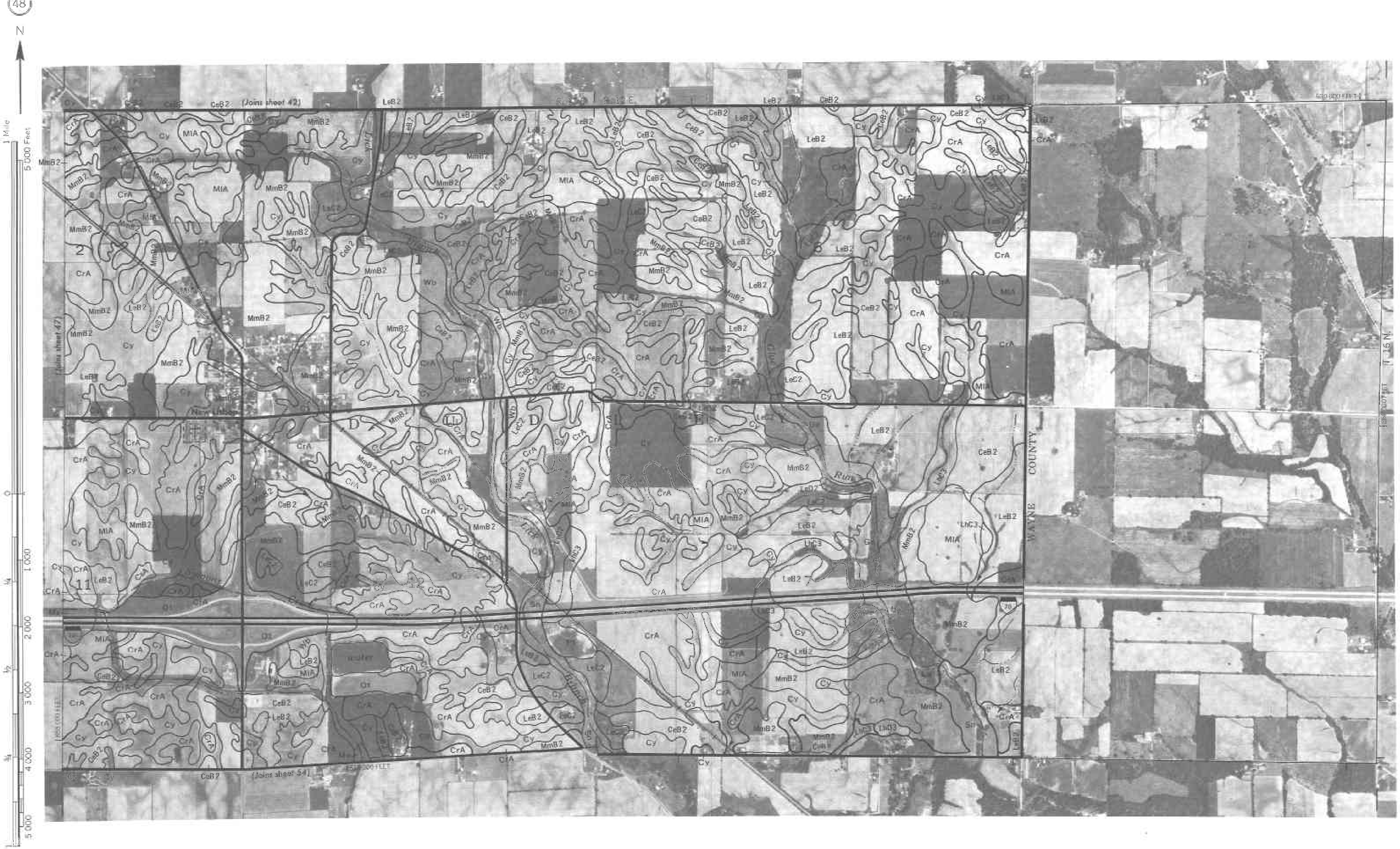

This map is compiled on [illegible] aerial photographs by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HENRY COUNTY, INDIANA NO. 46

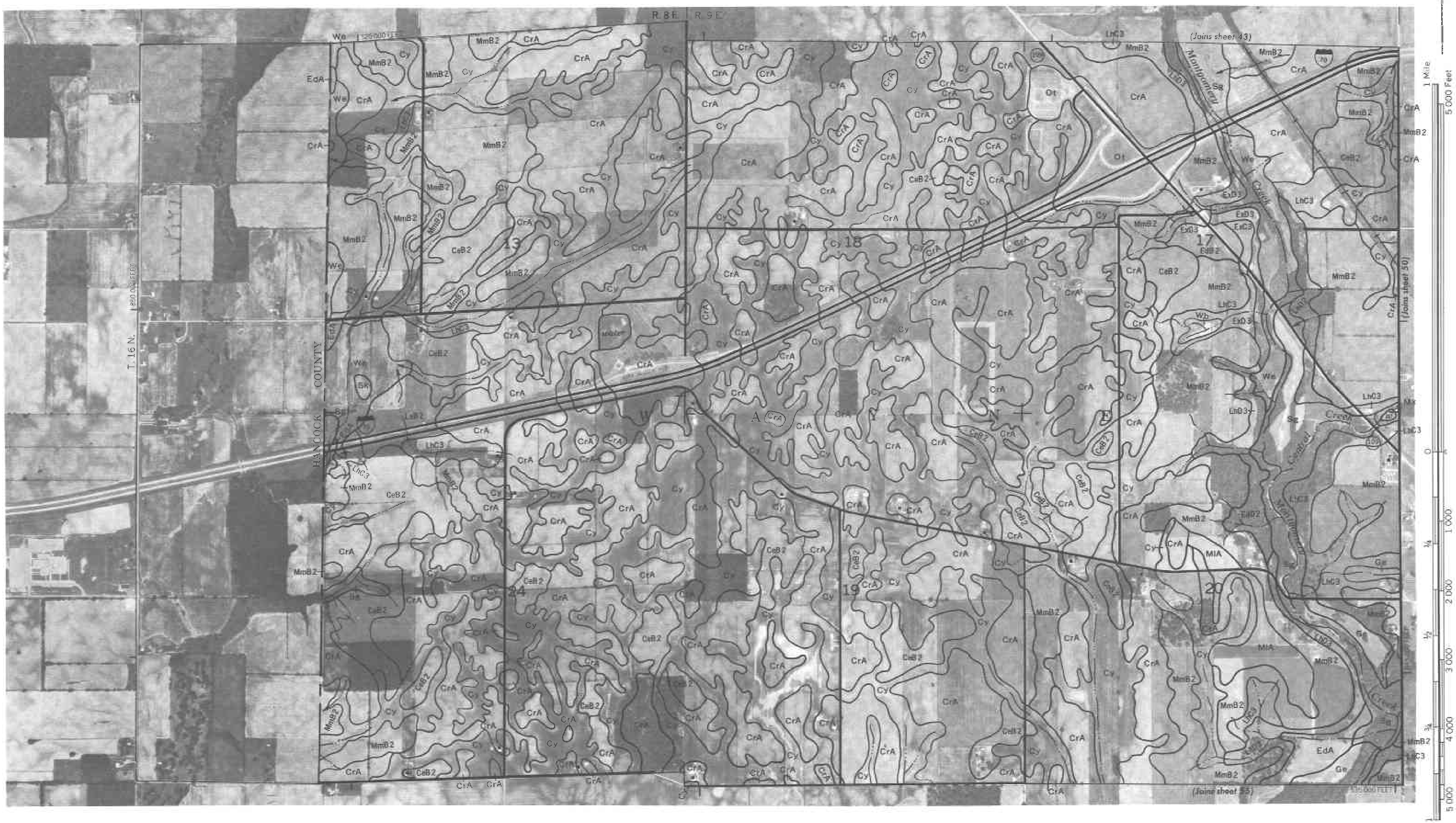
N




HENRY COUNTY, INDIANA NO. 47



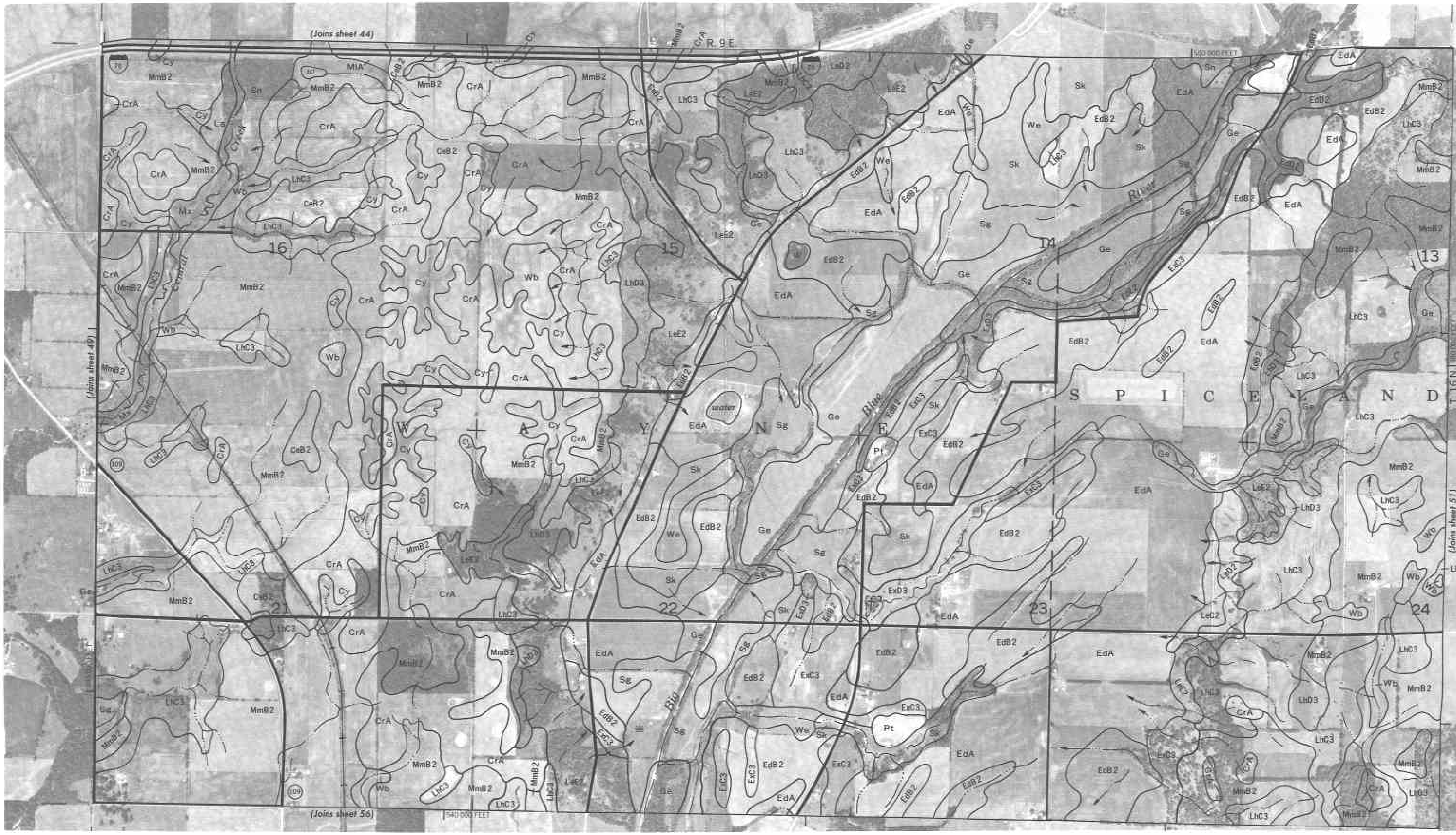

HENRY COUNTY, INDIANA NO. 48




HENRY COUNTY, INDIANA NO. 49

This map is compiled on [illegible] aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

50



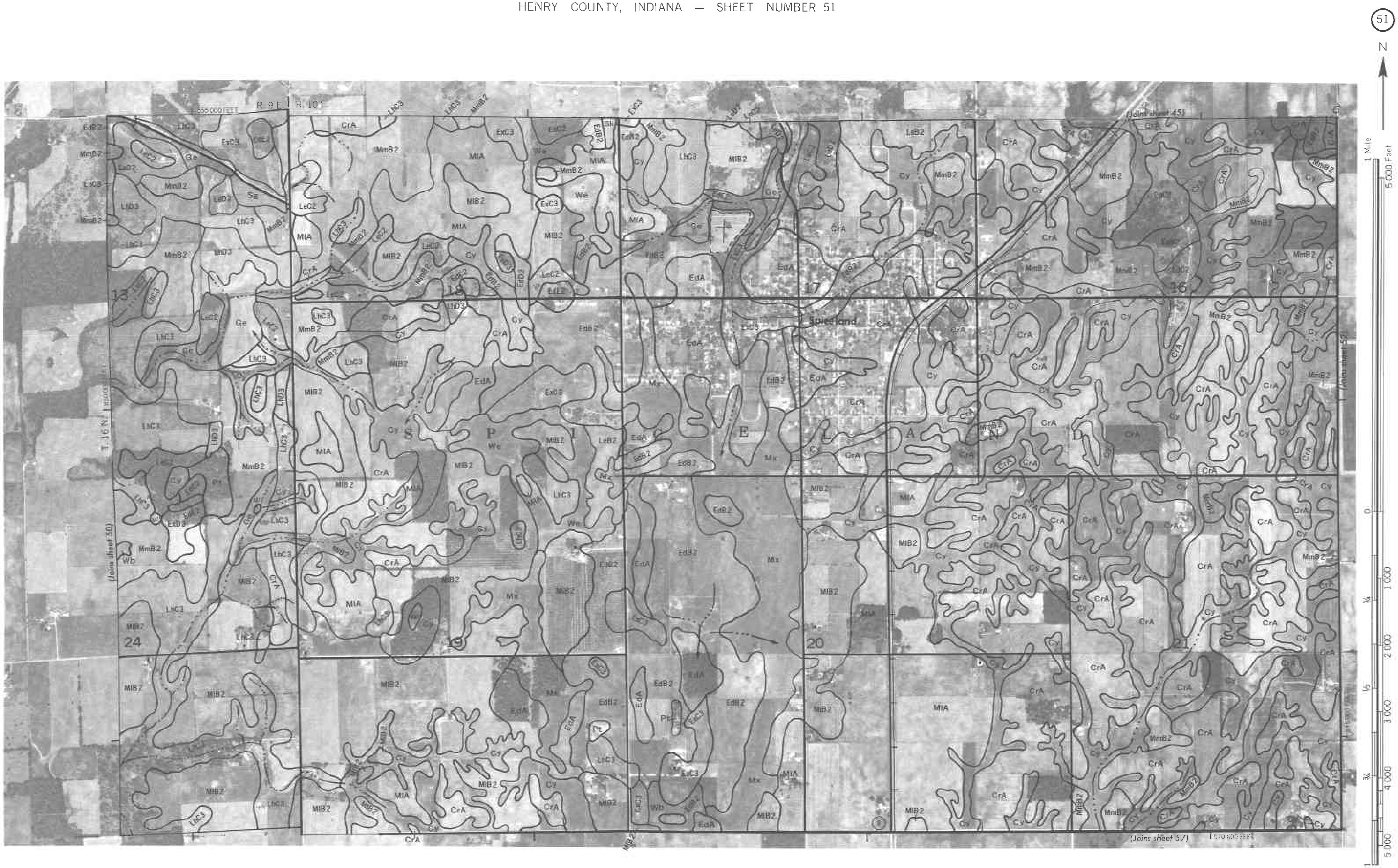

N

1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000

This map is compiled on 1971 aerial photographs by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

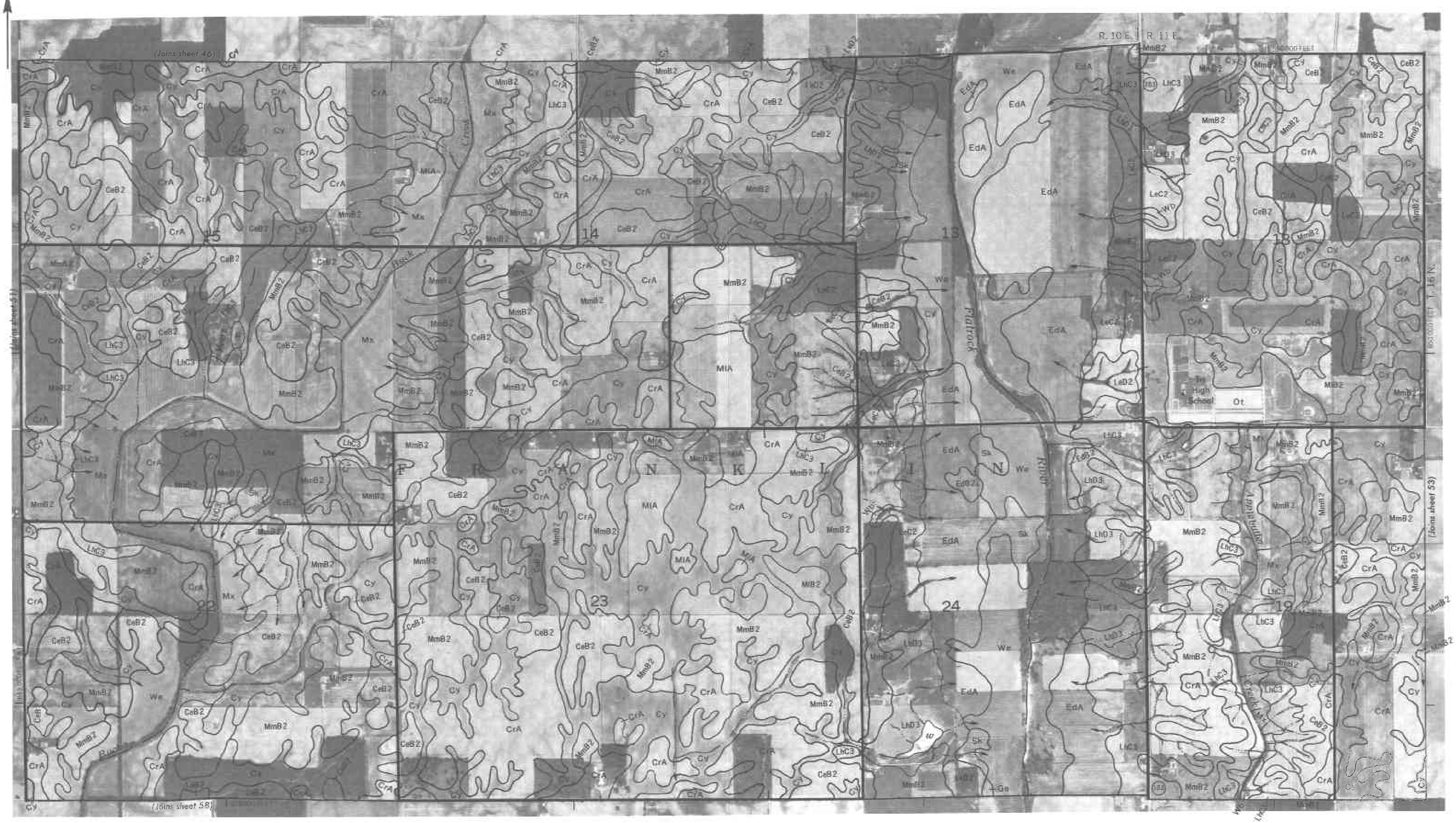
HENRY COUNTY, INDIANA NO. 50

HENRY COUNTY, INDIANA NO. 51



52

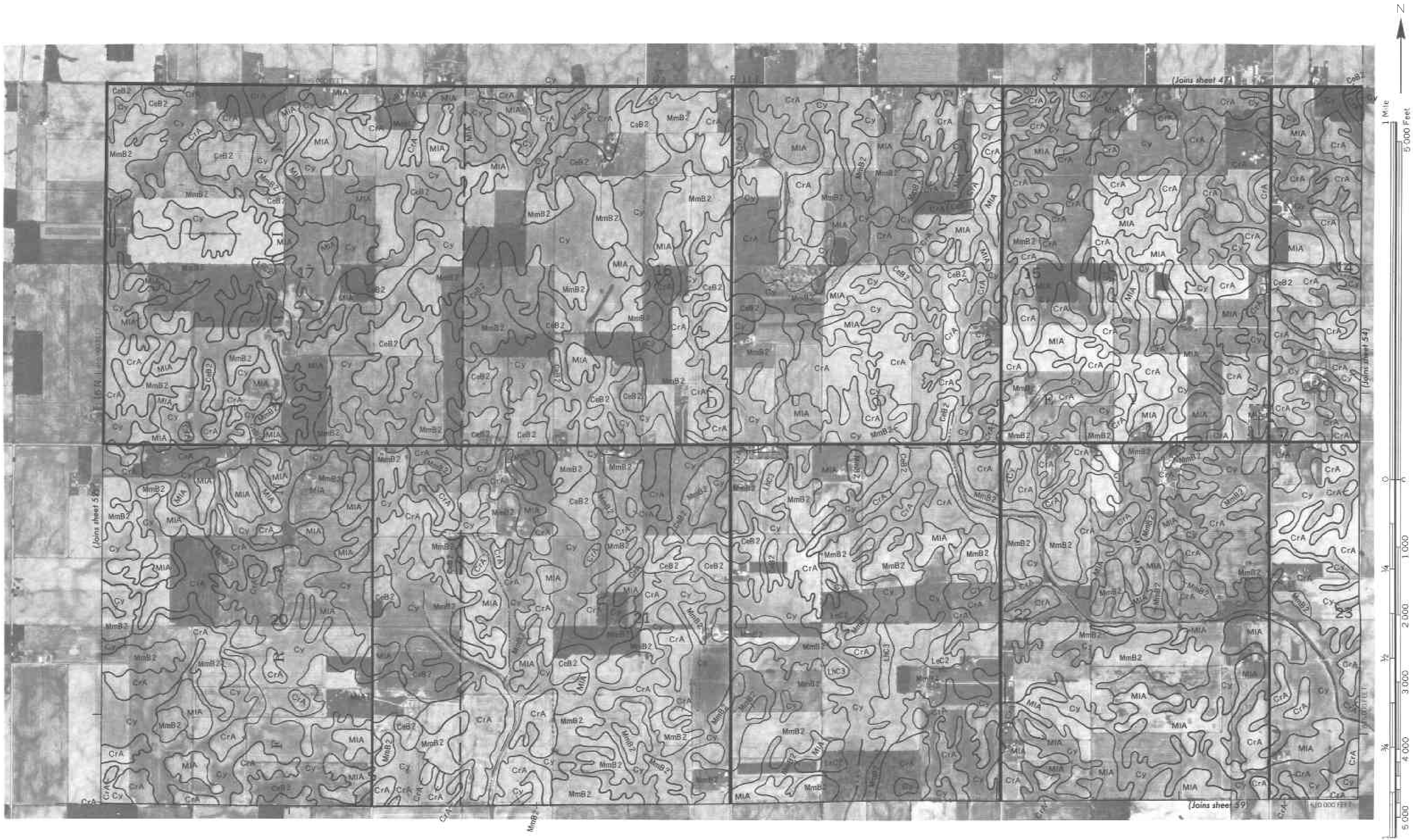
N



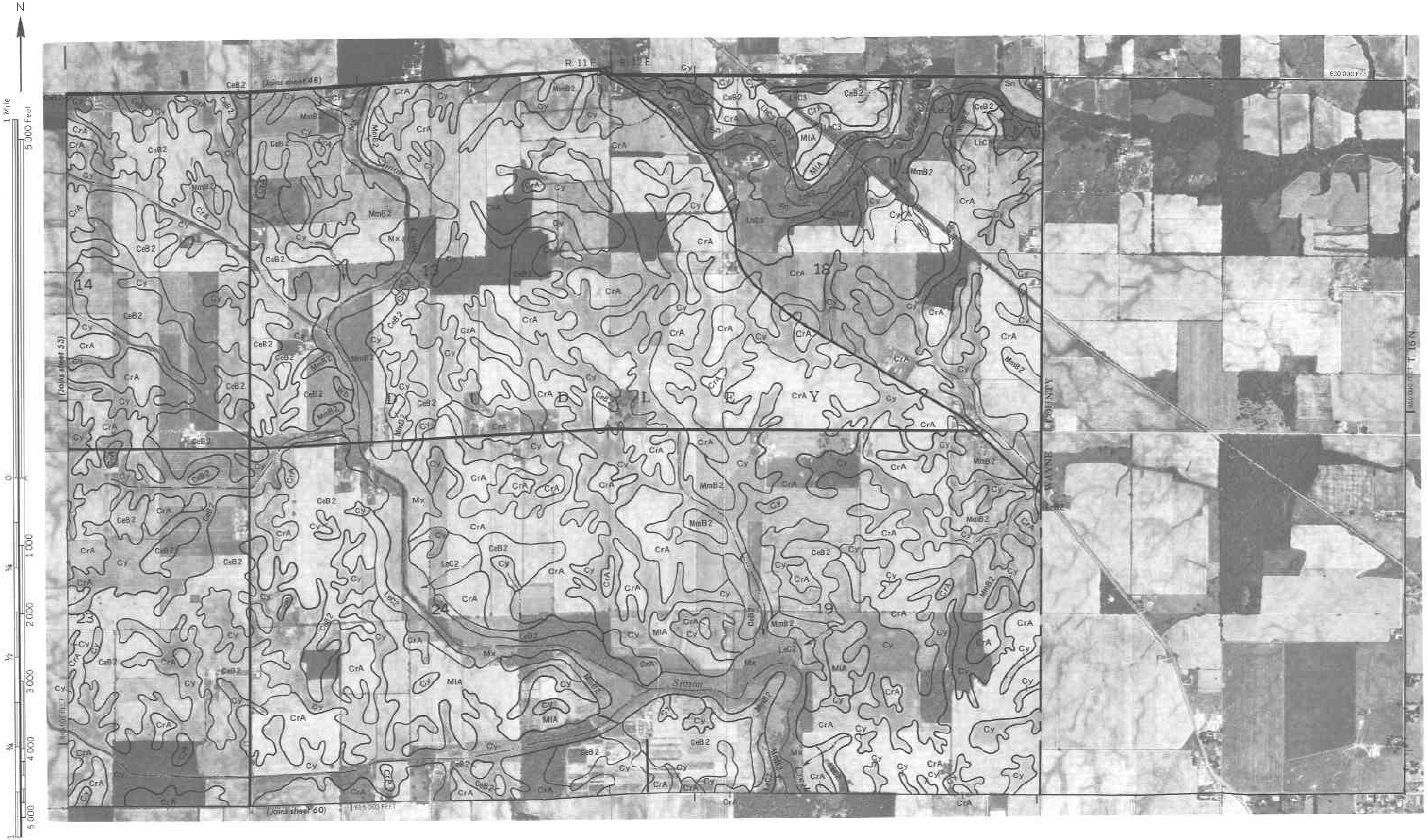

HENRY COUNTY, INDIANA NO. 52

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HENRY COUNTY, INDIANA NO. 53

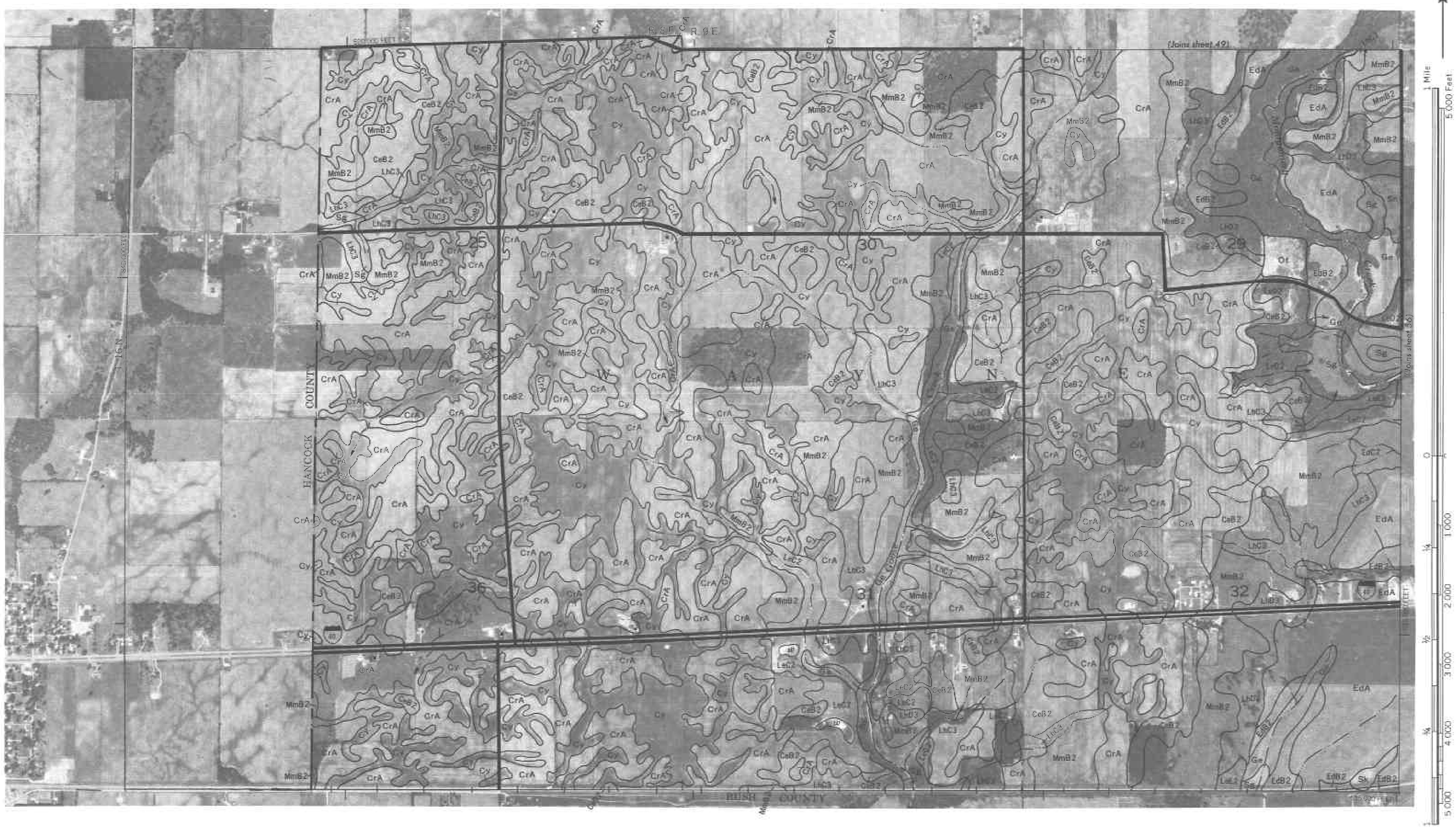


54

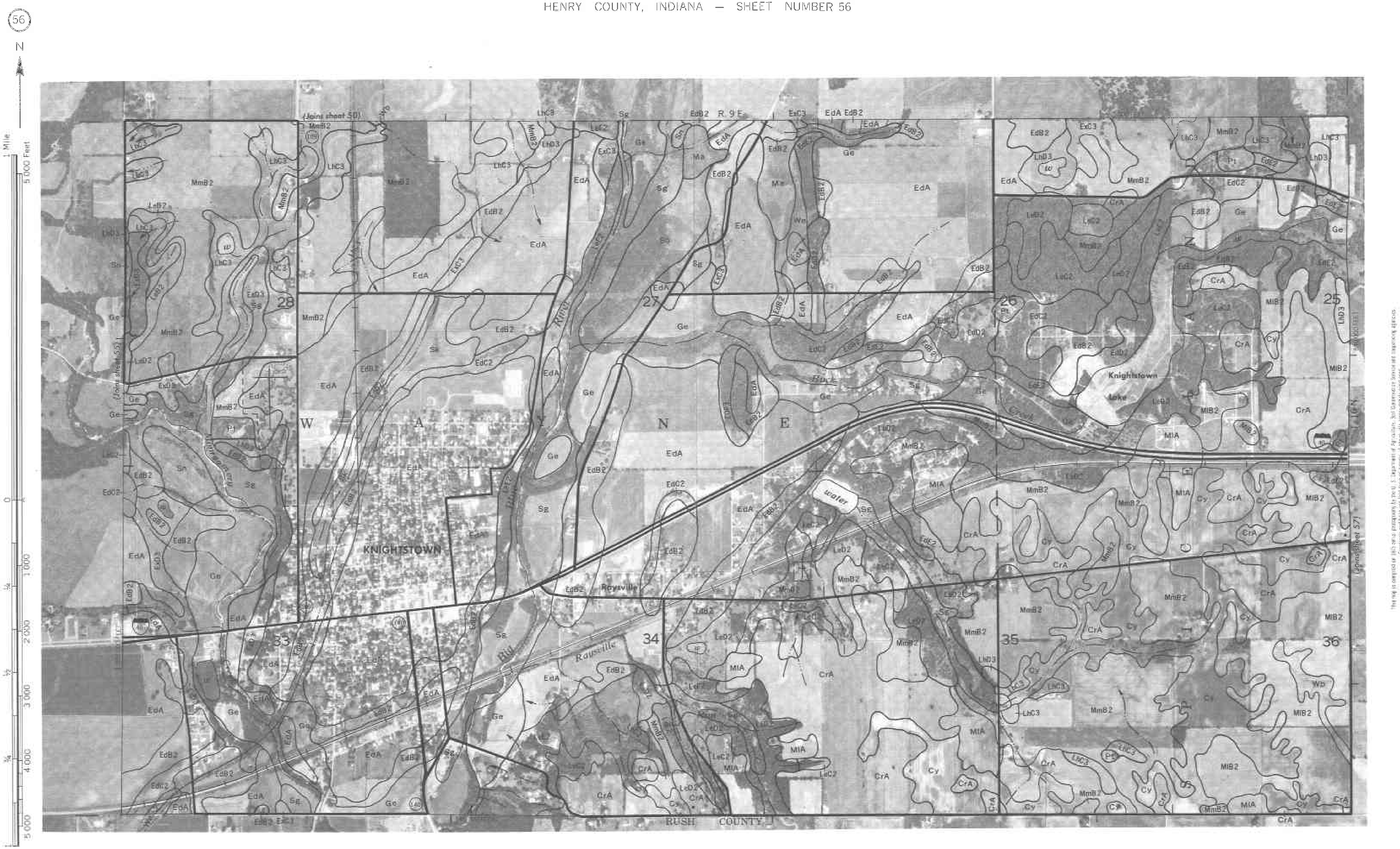


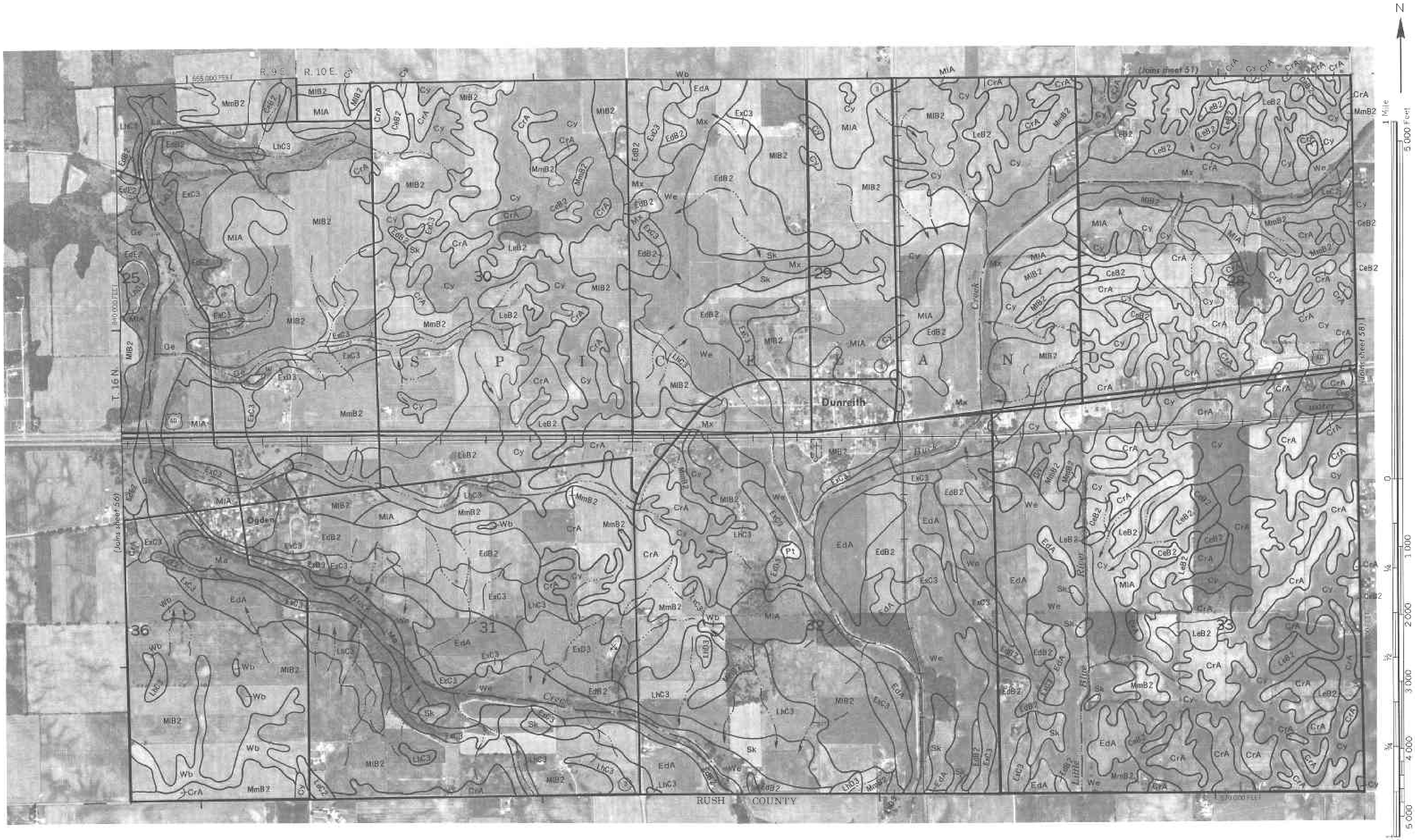

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HENRY COUNTY, INDIANA NO. 54

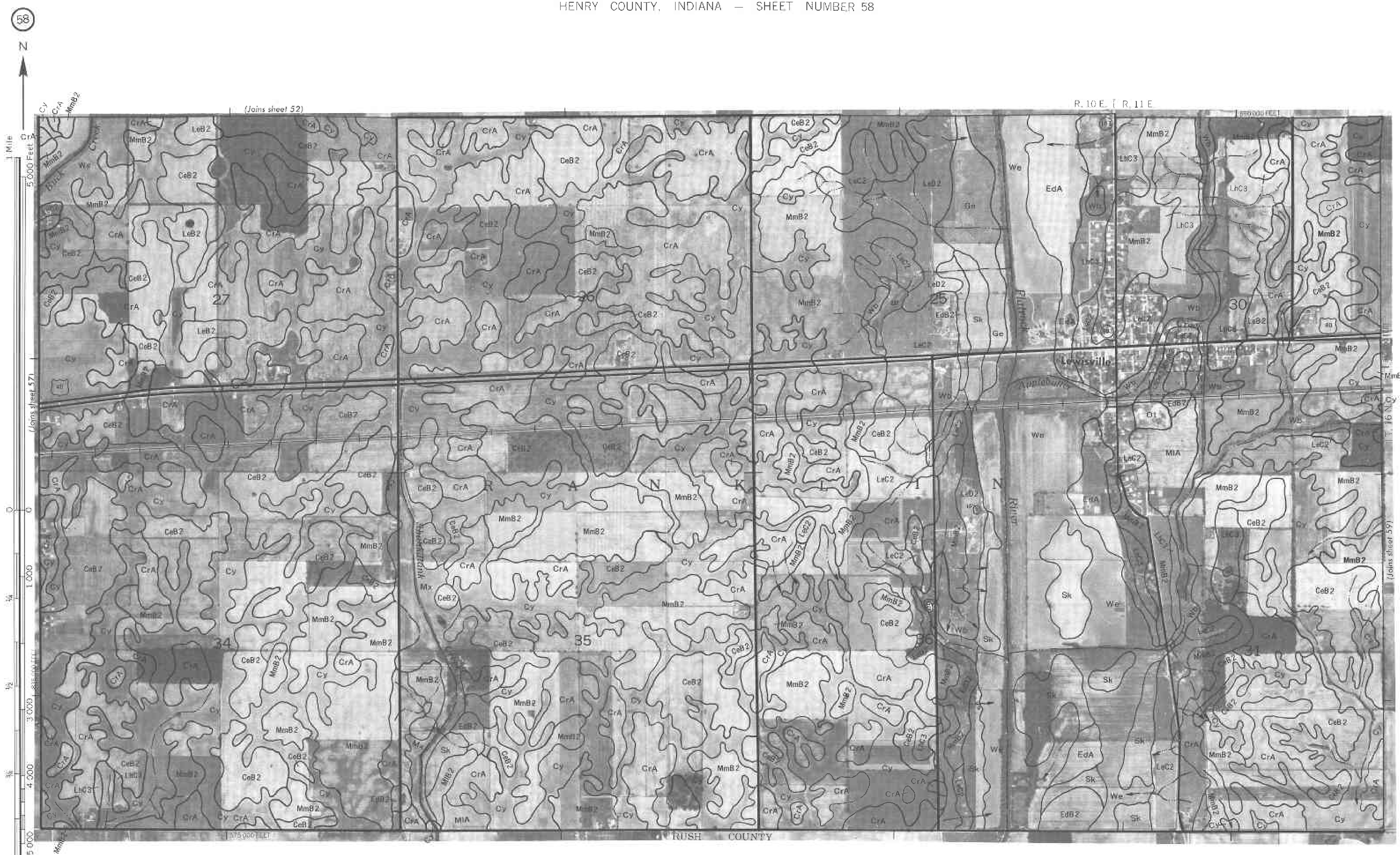



HENRY COUNTY, INDIANA NO. 55


56
N
(Joins sheet 50)
(Joins sheet 55)
(Joins sheet 57)
R. 9 E.
KNIGHTSTOWN
Knightstown Lake
Raysville
W A Y N E
RUSH COUNTY
water
Big Blue River
Buck Creek
28
27
26
25
33
34
35
36
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
HENRY COUNTY, INDIANA NO. 56

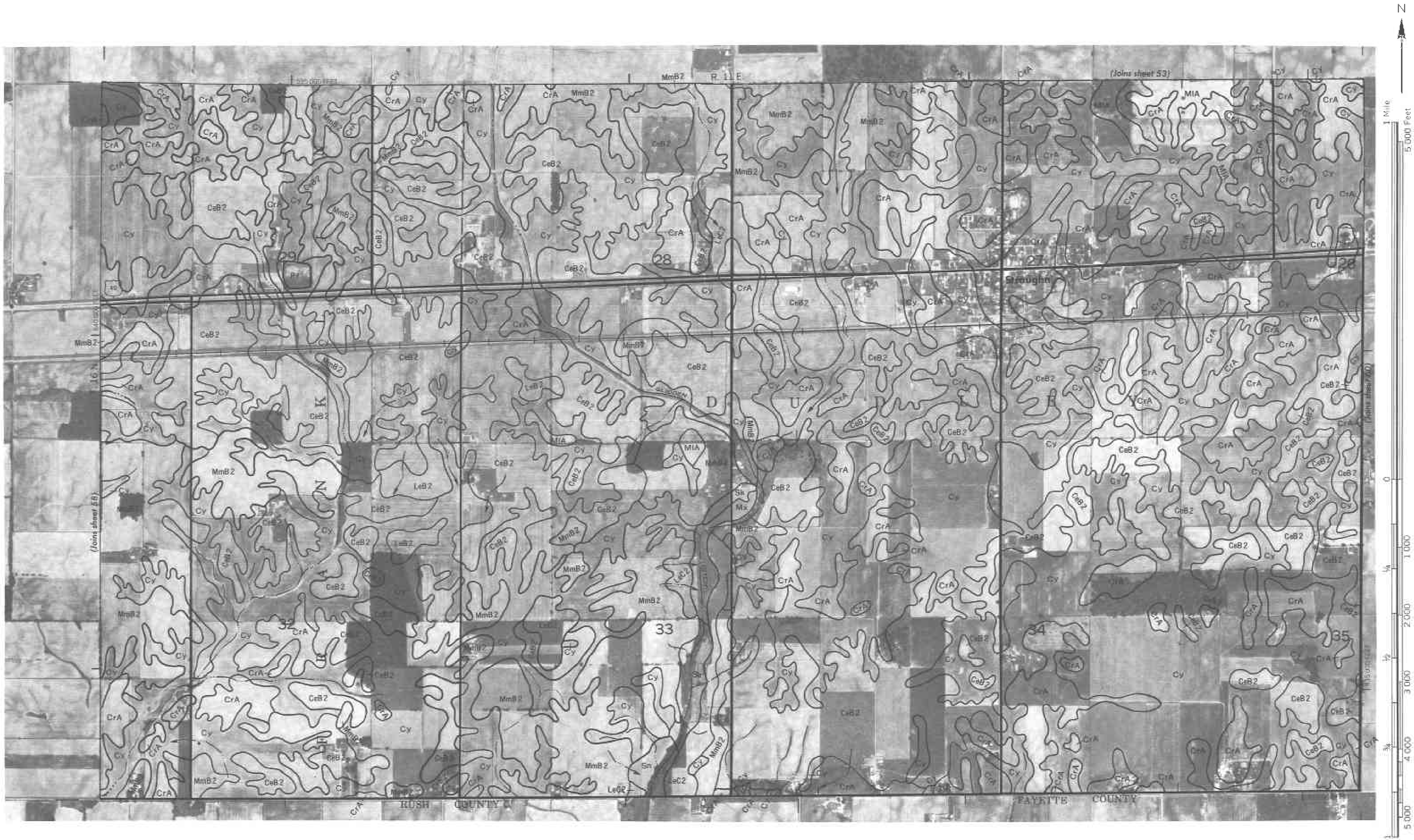


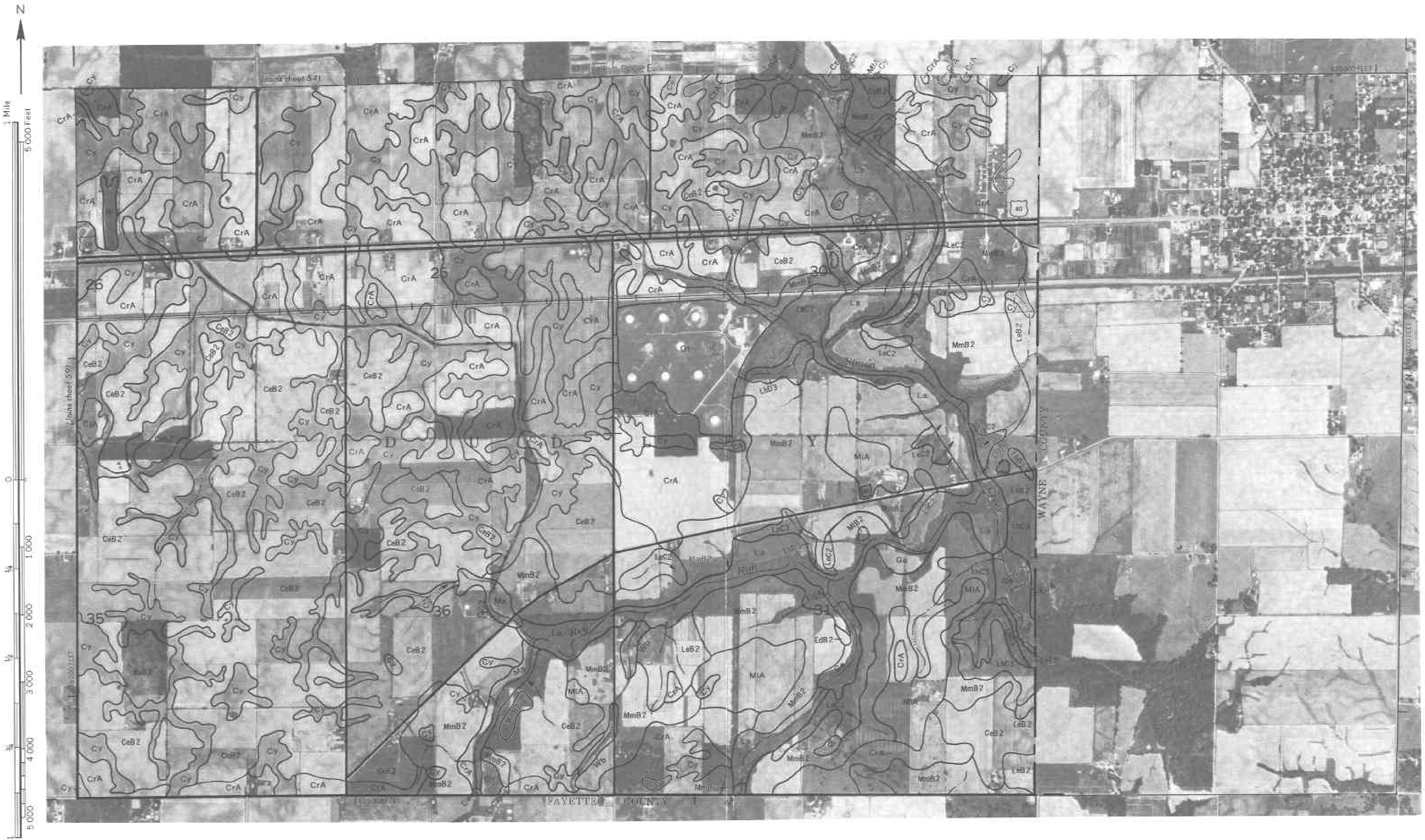

This map is compiled on [illegible] aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


58
N
(Joins sheet 52)
R. 10 E. | R. 11 E.
(Joins sheet 57)
(Joins sheet 59)
T. 16 N.
RUSH COUNTY
Lewisville
Buck Creek
Flatrock River
F R A N K L I N
27
26
25
30
34
35
36
31
1 Mile
5 000 Feet
1 000
2 000
3 000
4 000
5 000
0
¼
½
¾

HENRY COUNTY, INDIANA NO. 59

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.






HENRY COUNTY, INDIANA NO. 60